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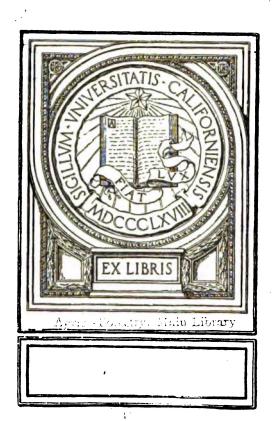
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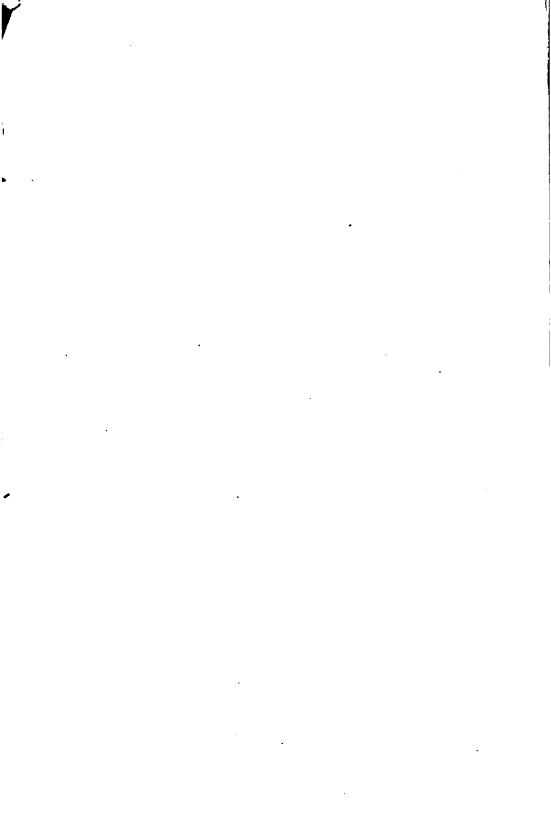
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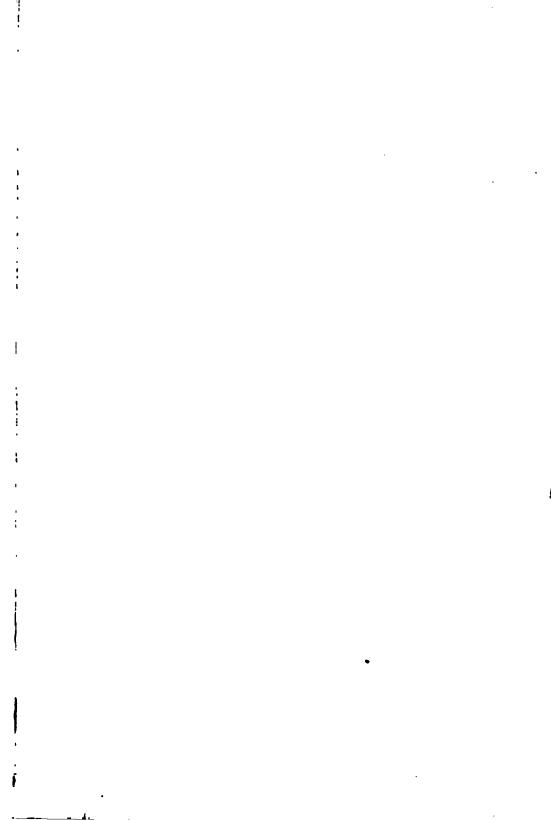
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 - Mountains, Roads and Trails. Santa Barbara, California.
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 - Trinity County, California.
 - Monthly Bulletin of the State Commission of Horticulture. Vol. VI, No. 10.
 - Farm Drainage Methods. By Walter W. Weir. Cir. No. 174. University of California Agricultural Experiment Station.
 - A Study of Farm Labor in California. By R. L. Adams and T. R. Kelly. Circular
 - 193, Univ. of California Agri. Exp. Sta. California Redwood Homes.
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The Construction of the Wood-Hoop Silo. By J. B. Davidson and J. E. Stiles. Cir. No. 173, University of California Agricultural Experiment Station.

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| Some Facts Concerning Arbor Day. Monterey

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Sixth Biennial Report of the State Forester of the State of California. 1916.

1917 Report of the Fruit Growers Supply Company. August 31, 1917.

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Plumas County, California.

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A New Dandrometer. By Donald Bruce. Vol. 3, No. 4. University of California Publications in Agricultural Sciences.



BULLETIN No. 20

See forwork

The Landscape Improvement

OF

Rural School Grounds

Written by

PROFESSOR J. W. GREGG,

Professor of Landscape Gardening and Floriculture
University of California

With Supplementary Lists of Ornamental Plants, by Assistant Professor R T. STEVENS and MISS KATHERINE D. JONES::::

Submitted by the

Commissioner of Elementary Schools
of California

CALIFORNIA STATE PRINTING OFFICE SACRAMENTO 1917 Apreciated to man inbrary

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FOREWORD.

THE LANDSCAPE IMPROVEMENT OF RURAL SCHOOL GROUNDS.

The following bulletin, written at our request by Professor J. W. Gregg of the University of California, with the addition of lists of trees, shrubs and flowers, suitable for school grounds, furnished by Assistant Professor Ralph T. Stevens, and Miss K. D. Jones, while designed to meet some of the immediate and pressing needs of our schools, has elements of permanent value. It, therefore, should not only receive careful consideration now, but be kept for future reference and study whenever the planning or planting of school grounds is to be undertaken.

The detailed plans for grounds are sufficiently numerous and varied to be distinctly helpful to any district where the school grounds are ample enough to admit of landscape treatment. Grounds of such amplitude are of course desirable for every school. It is not always feasible to provide them in large cities, but there is no suburban or rural district in California that can not have them if only there be a resolute and an intelligently directed effort to do so. In districts where the present population is too small to provide or to maintain such grounds, the desired ends can be obtained by judicious consolidation of neighboring schools. Such consolidation would result in a triple benefit, for not only could the school grounds be enlarged and beautified, but the school buildings could be made more spacious, and more convenient, while the courses of instruction, made more numerous and more varied, could be carried on under better conditions.

Professor Gregg says: "Little satisfactory development can take place on a half acre. One acre is small enough; and from three to five are not considered too much for the school that has seventy or a hundred children who must be provided with baseball, tennis, basketball and other games. As districts become consolidated and other community interests begin to center around the school, a need for larger grounds will be apparent. Land values will be constantly increasing and it is safe to predict they will never be lower. It should be considered good business therefore to acquire more land than may be needed immediately, in order to provide for future needs."

The first task then in school ground improvement is that of providing ample area. When that has been done, the planting plans will have practical value and the lists of trees and shrubs will be instructively interesting for years to come. Fortunately a large number of our rural schools have such grounds, and for them the bulletin has an immediate appeal through information, suggestion and counsel.

MARGARET SCHALLENBERGER McNaught, Commissioner of Elementary Schools.



No. 1. A school home, indeed, made so by numerous beautiful trees.

An elementary school in Butte County.

THE LANDSCAPE IMPROVEMENT OF RURAL SCHOOL GROUNDS.

By PROF. J. W. GREGG, University of California.

Introduction.—In this great state of California which Nature has so abundantly supplied with a wealth of resources and so much beautiful natural scenery, it would be reasonable to expect that every phase of rural life would be found developing in its own ideal environment. Strange as it may appear, however, the great amount of scenic wealth which Nature in a most generous mood so lavishly bestowed upon this fair state, has not made us appreciate fully the æsthetic or practical value of landscape beauty as it should exist around the "homes of men."

In many sections of California this scenic beauty has not been conserved, but totally destroyed to permit of a rapid economic development. In other parts where Nature was less generous we have not always sought to create that landscape wealth so essential to the health, happiness and prosperity of the inhabitants.

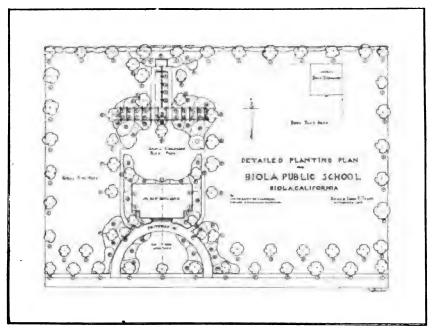
Our forefathers in New England, while facing problems involving their very existence, did not neglect the development of their home grounds or the improvement of their village streets, as the beautiful old colonial gardens and state American elms so frequently testify. The love for beautiful gardens and well developed home grounds which were such intimate parts of their lives in the mother country, continued to manifest itself, and not until the struggle for an independent national life began, did the spirit of progress in landscape gardening begin to wane. Later, as economic conditions began to improve and the people became more prosperous, there was a renewal of interest in better home surroundings and general civic development.

There were new and unimproved sections of this country, however, which in turn were destined to pass through the usual pioneer stage, but which were not quite so fortunate as New England, because colonial life with many of its cherished traditions had ceased to exist and the influence it had exerted over the landscape improvement of that section was partly lost to others. The Spanish padres in the early days of California established gardens around the missions, but with the advent of the white settler and the "days of '49" the interest in these gardens began to wane, and they have never since been very important factors in the landscape gardening of the state.

In the early days of California "gold" was in many cases the sole object in life, and the wandering prospector had little thought or need of anything else. The rancher—the truest home-builder of the nation, however—found himself in a new, undeveloped part of the country,

and though often possessed of little but his most personal belongings, still had thought and time for the improvement of his home environment. The years of toil and pioneering soon brought improved economic conditions, the necessities of life were provided for or were more easily attained, and the pleasures derived from better developed home grounds were soon realized. What had in the past been considered expensive luxuries were soon recognized as most valuable factors in the upbuilding of any individual or community.

We are now noticing a growing and widespread interest in landscape gardening as it deals with the improvement of home grounds, school



No. 2. An artistic yet practical development of a comparatively small area.

grounds, public parks, and numerous other phases of rural or city life, and it is the purpose of this publication to present in a very brief way a few suggestions concerning the proper improvement of the grounds surrounding those "school homes" in which the children of this state spend so large a portion of their young lives, especially at an age when surroundings count so much in the upbuilding of their mental, moral and physical fiber. If the "school home" is to compete with the temptations around about the growing child, it must be fortified with every excellent condition obtainable.

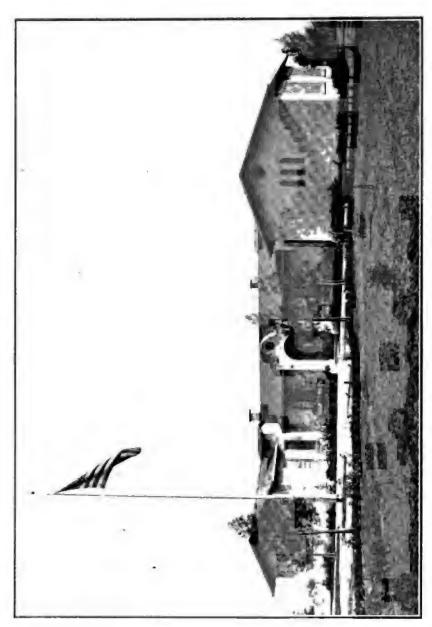
KEY TO PLANTING PLAN.

For the Biola Public School, Biola, California.

By University of California, Division of Landscape Gardening, October 24, 1916.

Group number	Number of plants	Botanical name
1	43	Eucalyptus viminalis.
2	18	Acacia baileyana.
3		Jasminum officinalis (Jessamine).
l	5 5 8 8 4	Ampelopsis tricuspidata (Boston Ivy).
	Ř	Lonicera japonica halliana (Honeysuckle).
	Ř	Olematis montana.
	ă.	Mandevilla suaveolens (Chilean Jasmine).
3		Viburnum ellipticum.
9		Heteromeles arbutifolia (Christmas Berry).
)	10	Leptospermum lævigatum.
1		Rosemarinus officinalis (Rosemary).
2	38	Cistus ladaniferus maculatus (Rock Rose).
B	9	Buddleia globosa.
1	4	Hakea saligna.
5	7	Lavendula vera (Lavender).
5 5	6	Oarpenteria californica.
7	9	Hakea suaveolens.
3	16	Ceanothus thyrsiflorus (Wild Lilac).
)	12	Melaleuca nesophila.
)	12	Acacia armata.
l'		Rhamnus californica (Coffee Berry).
2	2	Washingtonia filifera.
3	10	Myrtus communis (Myrtle).
<u> </u>	6	Raphiolepis japonica.
	11	Garrya elliptica.
3	11	Myrtus communis microphylla (Small-leaved Myrtle).
Z	9	Nerium oleander.
3	10	Cortaderia argentea (Pampas Grass).
	9	Spartium junceum (Spanish Broom).
)	110	Cupressus macrocarpa (Monterey Cypress).

Dr. Henry Suzzallo, president of the University of Washington, has truly said, "Tradition has decreed that the home of sovereignty shall be beautiful in its structure and setting. The palaces and estates of kings registered this custom among Europeans. How shall America, with local self-government and popular sovereignty, express its reverence for law and liberty? More than any other place, the public school is the seat of American sovereignty! It is the one institution that is visible to every citizen. The American counterpart of the European palace and estate is the American public school and school grounds. Let us make the schools of America as beautiful as they can be made fine, genial places, where children will be glad to work and citizens pleased to congregate for every neighborly purpose. Let every community learn from architect and landscape designer what can be done to make the intellectual and civic home of young American citizens expressive of the finest ideals we have of living. The example and influence will not be lost. Growing youth will carry new ideals of order and tidiness and beauty into their working lives. The grown neighbors of the school will take an attractive school's standard back



No. 3. What a difference plants make in the appearance of school buildings and grounds. The Pruitridge elementary school in Sacramento County.

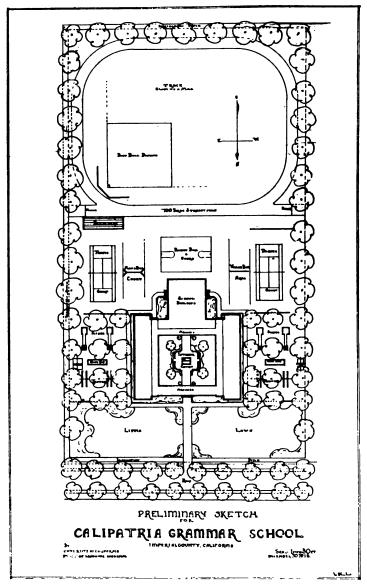
to their farms, orchards and homesteads, to enrich rural life and help to keep country boys and girls there."

During the last quarter century, the spirit of progress in the improvement of the architecture and physical surroundings of our public schools in general, has greatly manifested itself. School architecture has improved wonderfully, in the larger towns and cities of the state, but can we say as much concerning the architectural and landscape development of schools in the rural communities? In the majority of cases conditions are not materially better than they were twenty-five years ago. We regret that school grounds are not larger and more beautiful, and that the buildings are not more modern and better located.

Location and Size of School Grounds.—One of the first problems that should receive more serious consideration by school trustees is that which concerns the size and location of school grounds. A site should be chosen—other conditions being satisfactory—that is as centrally located as possible in order that distances may be shortened to accommodate the largest number of children. The land should be reasonably level in its natural contour, as little or no grading will then be required to establish satisfactory play areas or care for other features that are more difficult to locate on rough irregular surfaces. Baseball, tennis, basketball and other desirable games are played with greater satisfaction and pleasure on level ground, while problems of irrigation in connection with ornamental plantings or school gardens are less difficult of solution. School grounds that are comparatively level are maintained at less expense, present a much better appearance, and permit of a more economic and pleasing development. The time is past when land which has been condemned for other purposes, because of its poor location, poor soil or rough contour, should be purchased for school use. The low cost of such land is usually the determining factor, but it proves to be the most expensive in the end if an ideal development is wanted.

Besides being poorly located, many school grounds are entirely too small. Such areas not only fail to provide for the modern requirements of the school proper, but for the civic needs of the community as well. The time has arrived when the school may properly become the civic center of rural life, and as such, it should be equipped with sufficient land to provide for all the needs of a progressive community. It is now generally acknowledged that children must play and that the playground is an absolute necessity, a little world, with its own problems and interests, in which are taught tact, management, leadership, quickness of thought and action, and many other sterling qualities for which the coming generations will have great need. For this reason,

if no other, school grounds should be of sufficient size to provide for all the larger as well as the smaller games and athletic sports that boys and girls delight in.



No. 4. A well-balanced development of a rectangular piece of school property.

School grounds should be large enough to permit of the building being located far enough back from the road that the noise and dust from passing traffic will not become a nuisance. A pleasing landscape approach and setting for the building is a most valuable asset. It indicates the progressiveness of the district, and above all, is attractive rather than repelling to the school children. Youth is quick to recognize and respond to the influence of "beauty" in the form of trees, shrubs, vines and other landscape material, and the larger the grounds, the greater the opportunity for making them attractive. The problem of maintenance, with respect to cultivation and irrigation, has often determined to a certain extent the size of school grounds and the amount of landscape improvement. This problem is easily solved, however, when a cooperative spirit is developed among trustees, parents, teachers and students.

Little satisfactory development can take place on a half acre. One acre is small enough and three to five acres are not considered too much for the school that has seventy-five or one hundred children, who must be provided with baseball, tennis, basketball, and other play space. As districts become consolidated and other community interests begin to center around the school, a need for larger grounds will be apparent. Land values are constantly increasing, and it is safe to predict they will never be lower. It should be considered good business, therefore, to acquire more land than may be needed immediately, in order to provide for future development.

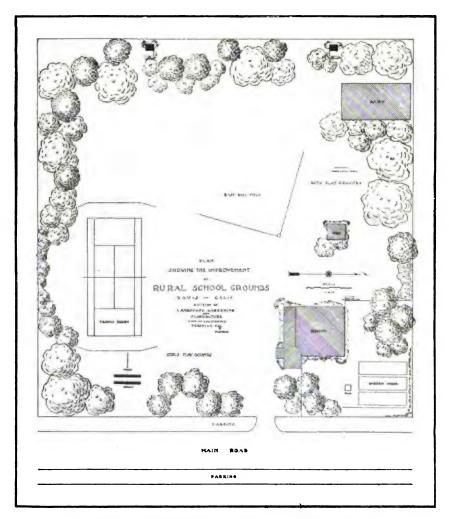
Orientation and Shape of Grounds.—The development of school grounds is influenced also by their exposure and shape; good light at all times, sun during the winter months and protection from severe prevailing winds, are three very important factors to be considered in selecting and improving school property. The orientation and shape of the grounds should determine the location of all buildings, play areas, windbreaks and other mass plantings, in order that the maximum of utility, convenience, comfort and beauty, may be obtained.

Properly located windbreaks in the form of large mass plantings of trees have made many sections of California and many farm homes more livable, and they should prove just as valuable for school grounds.

Long, narrow pieces of land necessitate a different arrangement of features from those that are square or triangular in shape. Irregular shaped grounds are difficult to develop economically or æsthetically, while those that are square or in the form of broad rectangles, offer much better opportunities for a systematic arrangement of all features. Desirable distant views, water supply and sanitation are other important factors that should be considered in connection with orientation when selecting the school site, because they may influence materially the whole design. A site having a warm south or southeast exposure, and a contour which permits of good surface drainage during the rainy

season, is generally considered ideal, although other exposures may be deemed more desirable in certain sections of the state.

Walks and Drives.—Walks and drives are not in themselves very ornamental and good ones are most expensive to construct. They are more or less necessary, in order that the principal features of the

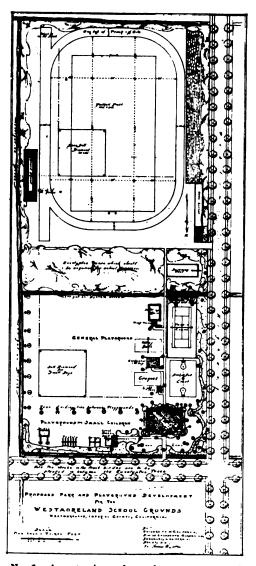


No. 5. An informal development of a small rural school.

grounds may be readily accessible. They may add or detract from the whole design, however, as they are properly or improperly located, or as they approach the extreme in number and width. On small grounds, or when the building is close to the road, one entrance with a straight single or double walk, usually looks better and is most serviceable.

When the grounds are large, and the building is located farther back from the main road, more than one entrance may be required and the road or walk laid out in easy, graceful curves. The number, width and arrangement of walks and drives will depend, of course, upon the location of the features they are to serve and the amount of traffic they will be required to care for. A service drive should be provided and so located as to facilitate the delivery of fuel and other supplies, and to make horse-sheds, barns or garden areas easily accessible. Walks and drives are usually too numerous, too wide, and poorly located, with the result that they are very conspicuous and costly features. The principal walk from the road to the building may be from six to ten feet in width. In some cases, however, the architectural lines of the main entrance of the building may require the walk to be wider for the sake of appearance. Minor walks may be from three to five feet, according to the number of children that might be expected to use them at one time. Service drives may be as narrow as eight feet. Ten feet is much better, however, and twelve or fifteen may be necessary under some conditions. It is impossible to establish any definite widths for walks and drives that would meet the requirements of every school. Good judgment has to be exercised in every case and the principal factors of utility and beauty thoroughly considered.

The main walk, and perhaps some others near the building, should be permanently constructed of concrete or brick, in order that they may furnish a clean solid surface under all weather conditions and be less expensive to maintain. Gravel, crushed rock or dirt walks, are seldom satisfactory and are expensive to maintain in even a reasonable condition. These materials may have to be used for the less important walks, however, and for drives and playground surfaces.



No. 6. An extensive and complete arrangement of a long, narrow piece of school property.

KEY TO PLANTING PLAN.

For Westmoreland School, Imperial County, Cal.

By Division of Landscape Gardening, University of California, December 27, 1916.

Group number	Number of plants	Botanical name
	61	Leptospermum lævigatum (Australian Tea Trec).
	64	Punica granatum (Pomegranate).
	10	Oleander (red).
	2	Strelitzia regina (Bird of Paradise Flower).
	21	Myrtus communis (Common Myrtle).
		Myrtus communis microphylla (Small-leaved Myrtle).
	6	Zizyphus jujuba (Jujube).
		Choisya ternata (Mexican Orange).
		Prunus laurocerasus (English Laurel).
	7	Myrtus luma.
	86	Lantana (Dwarf Orange).
		Fraxinus velutina (Arizona Ash).
·		Pittosporum tobira.
		Raphiolepsis japonica.
		Ampelopsis tricuspidata (Boston Ivy).
	3	Japanese Lantern Vine.
		Figus pumila (Creeping Fig).
	24	Carpenteria californica.
	4	Ceratonia siliqua (St. John's Bread).
	31	Polygala dalmaisiana.
	4	Bignonia buccinatoria (Trumpet Flower).
,	3	Lantana camara.
	4	Bignonia venusta.
	2	Tecoma australis.

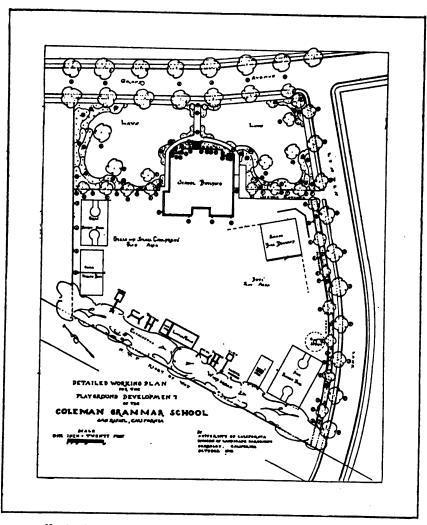
Playgrounds.—As previously stated, playgrounds are considered an absolute necessity. Children must play, even in the country, and school grounds should be designed to provide for all the healthy games boys and girls delight in. The boys' play area should contain a baseball diamond, basketball and handball courts, and some kind of a running track, no matter how small, or if nothing more than a straightaway. Provisions should also be made for high and broad jumping and, possibly, volleyball. Nowadays girls are indulging in all of the above mentioned games, but more especially basketball, volleyball and Therefore, a girls' play area which will provide for these games, must also be located. The boys' playground is usually the largest, due in part to the greater area required for baseball. be separated, nevertheless, from the girls' area by some apparently natural line of demarcation, such as a walk, drive, line of trees, hedge, fence or pergola. Tennis is a very popular game with all children, and it is usually advisable to locate one or more courts where either boys or girls may make free use of them. Where there are a number of very small children in the school, a third play area must be located which will contain swings, seesaws, sand-boxes, slides, etc. The location of the various play areas, mentioned above, must be made with due respect to an economic division of the land, protection from severe winds, orientation, supervision, safety, and last, but not least, beauty. In the major-



No. 7. A good level open space for exercise and general play is most desirable. Playgrounds at Chico Normal Training School.

ity of cases a good dirt surface for play areas will give as much satisfaction as more expensive types, especially if they can be crowned slightly to care for surface drainage during the winter months. Sometimes, however, gravel or fine crushed rock and oil will be found very desirable.

School Gardens.—Gardening in different forms is now being taught in many schools and this work should be provided for where the soil is good and where the area will not be unsightly when not in use. Often a tool house, lath house and frames will be needed and they should be located in harmony with other surrounding features. The area should be inclosed by a hedge or good wire fence, over which roses and ornamental vines may be grown. This latter recommendation applies also to the school property as a whole. A good substantial woven wire fence, well painted and overgrown with attractive vines, not only adds materially to the appearance of the whole scheme, but protects all interior features as well.



No. 8. A satisfactory arrangement of school grounds of irregular shape.

KEY TO PLANTING PLAN.

For the Coleman Grammar School, San Rafael, California, October 23, 1916.

Group number	Number of plants	Botanical name
1	17	Platanus orientalis (Oriental Plane).
2	14	Acacia melanoxylon (Blackwood Acacia).
3	19	Lonicera japonica halliana (Honeysuckle).
1	22 29 2 1 1 2 7	Escallonia rubra.
5	29	Euonymus japonicus.
3	2	Ables nordmanniana (Nordmann's Fir).
	1	Abies pinsapo (Spanish Fir).
3	1	Oedrus deodara (Deodar Cedar).
?	2	Prunus persica, double red (Flowering Peach).
?	7	Ampelopsis tricuspidata (Boston Ivy).
<u></u>	2	Eugenia myrtifolia.
2	10	Oydonia japonica sanguinea (Japanese Quince).
3	88	Oarpenteria californica.
<u> </u>	14	Escallonia montevidensis.
5	.8	Coprosma baueri.
<u>B</u>	12	Choisya ternata (Mock Orange).
7	10	Myrtus communis (Myrtle).
<u>B</u>	14	Myrtus communis microphylla.
9	12	Raphiolepis japonica.
9	.2	Prunus lusitanica (Portugal Laurel).
1	19	Veronica decussata.
3	14	Pyracantha crenulata (Burning Bush). Pyracantha coccinea lalandii.
4	8 9	Oytisus scoparius andreanus (Scotch Broom).
5	4	Berberis stenophylla.
6	9	Acacia armata.
7	18	Callistemon lanceolatus (Bottle Brush).
8	9	Melaleuca nesophila.
9	ĭ	Arbutus unedo (Strawberry Tree).
0	ģ	Heteromeles arbutifolia (Christmas Berry).
1	20	Oistus ladaniferus maculatus (Rock Rose).

Ornamental Plantings.—Trees, shrubs, vines, annual and herbaceous plants, may now be considered as the necessary ornamental material with which the skeleton of the whole plan is clothed and beautified. Many people have a tendency to think of plants as the whole of land-scape, and landscape gardening as that practice which considers only their propagation, planting and care. Landscape gardening in the light of modern thought and practice is an art which seeks to arrange the surface of the land and all elements on the surface for human use, habitation and convenience, and enjoyment, in such way, as to create a beautiful picture or composition, possessing all the economic and esthetic qualities of an organized whole.

Plants of various kinds, however, are most important elements in the majority of landscapes and more of them should be used in the embellishment of school grounds. Nothing adds more to the beauty or utility of such areas than a good collection of judiciously arranged and wellgrown trees and shrubs. Trees may be planted in such a way as not only to frame the school building, but to preserve desirable distant views. They may also serve to check severe winds, screen objectionable views and furnish shade, if needed. Ornamental shrubs in variety may



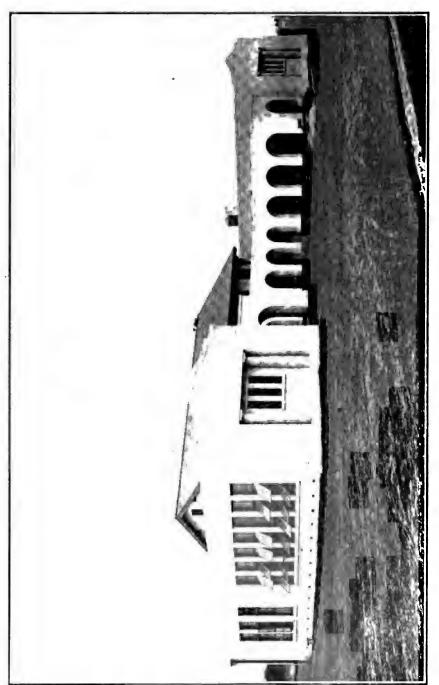
No. 9. The play area for the small children should be near the building and as attractive as possible. Playgrounds at San Jose Normal Training School.

be planted around the base of the school building, at intersections of walks or drives, in out-of-the-way corners, and for the screening of low objects. They should never be scattered promiscuously as individual specimens over a large area, and should not be planted in regularly defined beds in the center of lawn areas or where they will interfere in any way with general playground features. They also serve as "facings" for tree groups and as "filler material" in windbreaks or larger screen plantings. Vines are useful in covering fences, lunch houses, pergolas and trellises. Even the appearance of the school building may often be improved by some kind of vine growth. Annual and herbaceous plants may be used in shrubbery borders and in many other situations where they will give that trace of color so pleasing to the eye.

It is impossible to enumerate all the uses which different kinds of plants may be put to, the desirable effects they can produce, or the service they can render. They not only possess an æsthetic value, but an economic value as well, which is hard to state in the terms of money. Here in California, with such a wide range of climatic and soil conditions, and a most extensive flora, both native and exotic, there is no reason why our school grounds should not be the best developed and the most beautiful of any in America. To accomplish all this, however, each problem has to be studied in a systematic and business-like way, and definite plans prepared in advance.

Landscape Plans.—Plans for the economic and æsthetic development of school grounds are just as essential as architectural plans which govern the design of a building. Without plans, the maximum of utility, convenience, comfort and beauty can not be obtained in the development of school grounds. Such plans should be prepared even though it may take several years to carry them out in all details. One year the walks and drives may be put in, the next year some of the planting may be done, and so on as finances permit, until at last the completed scheme will be one to be proud of, because everything will have been provided for in the most useful and beautiful way.

Selection of Plant Material.—All trees, shrubs, vines and other plants to be used in the beautifying of school grounds, should be carefully chosen with respect to their adaptability to the soil and climatic conditions of the particular site and section of the state. They should be varieties that will produce the greatest service and effect for the amount of care and attention they will later receive. The class of material found growing in nurseries under local conditions should be taken as a guide in the selection of varieties. There is also much desirable native growth that is well adapted to planting in many sections of the state. Plants that thrive and produce desirable effects in the cool climate and heavy soils of San Francisco Bay region may not prove



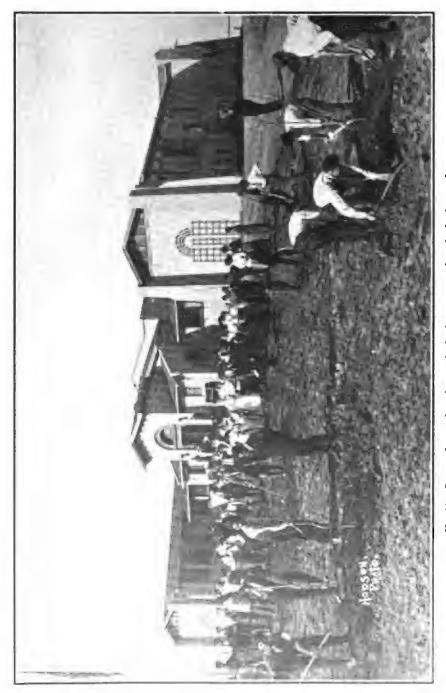
No. 10. A new type of school srchitecture which will be greatly improved by shrubs, vines and trees. An elementary school in Sacramento County.

at all successful in the hot interior valleys. Numerous other similar examples might be cited to show how important it is to study local conditions and select varieties of ornamental stock that will prove the most satisfactory with a reasonable amount of care.

Planting and Care.—Choosing varieties of plants that are adapted to local conditions is not the whole problem, however, as many people Their future growth for service and beauty will depend upon how well they are planted and how much care they receive until they become established. Many failures may be traced directly back to haphazard planting, and neglect. Too much attention can not be given to the preparation of the soil where plants are to grow. It should be worked as deep as possible in order to improve the physical condition and permit the roots of the trees or shrubs to grow down deep and away from the surface. Hard, packed soils force plants to become shallow rooted, to the extent of their requiring a larger amount of water during the summer, to keep them alive, or they blow over when the soil becomes rain-soaked in winter. Deep working of soils and the diggings of large holes at the time of planting means much in the establishment and later growth of the plant. Many soils will be greatly improved by adding a good quantity of stable manure before planting, such material not only enriching the soil, but greatly improving its physical condition. Lime is also becoming an important element in the improvement of many California soils and should find wider use in landscape gardening.

After the soil has been well prepared, the trees and other material properly planted, attention should then be given to staking, irrigation, cultivation and mulching. One of the great number of objections that have been offered in the past against the planting of school grounds is, that it is impossible to properly care for the plants during the long dry period when the school is not in session. This is not such a big problem as it appears to be. In many sections of the state severe winds at different seasons often "whip" the young trees and shrubs around until they become broken or partly uprooted. Some redwood stakes driven firmly into the ground at the time of planting will prevent such damage and assist greatly in establishing firm root growth. Such stakes do not cost much and may be the means of saving many trees.

All plants should receive a thorough watering at the time of planting, in order to settle the soil around the roots and help them to become established as soon as possible. After the surface soil has dried out sufficiently to permit of its being cultivated, it should be worked into a fine dirt mulch which will help to keep down weeds and conserve a great amount of water for the immediate growth of the plants. Such treatment is not necessarily expensive if parents and children can be cooperatively interested to the extent of having a "Gardening Day"



No. 11. One good way of getting results in the ornamentation of school grounds.

The high school boys planting trees on grounds of the San Juan Union High School in Sacramento County.

now and then when such details as cultivation, irrigation and pruning may be properly attended to. Such thorough cultivation after the first watering postpones considerably the need for a second irrigation, which, in turn, may be followed by another cultivation or the plants mulched with fine old straw or stable manure. As a rule, three good irrigations during the dry season, with due attention given to good cultivation or mulching, will be sufficient to establish the plants and produce a satisfactory growth. Some plants will die under the best of care and some loss should be expected. Such plants, however, can be replaced the second season and no time will be lost in producing the final effect.

If ornamental plantings can receive a reasonable amount of care for the first two or three years, they may do fairly well with less attention later. It should be remembered that the great majority of plants will produce their best growth if given some care in the form of staking, irrigation, mulching, fertilizing and pruning. It is true there are many native plants in California that seem to be adapted to adverse soil and climatic conditions, but, as a rule, they are not varieties that we want entirely on our home or school grounds.

The list of plants that accompany the plans illustrated herein and the larger lists that follow will, it is hoped, give some idea as to the class of plant material that can be used for various purposes in the planting of school grounds. They are merely suggestive and make no pretension to being complete. Neither has this bulletin attempted to discuss in great detail the numerous problems involved in the systematic development of modern school grounds. It is hoped, however, that the subject as a whole has been presented in such a way as not only to make clearer to school boards, teachers and parents the need for better conditions around the "intellectual homes" of our boys and girls, but to guide them in the solution of their own individual problems by pointing out in a general way some of the great factors involved.

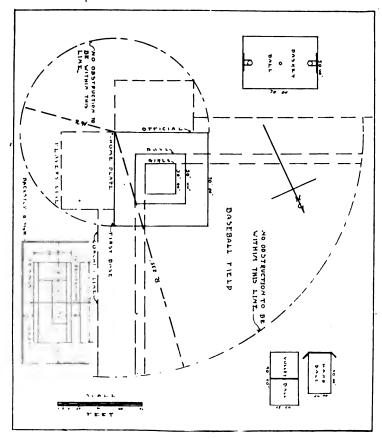
I LIVE HERE.

By STRICKLAND GILLILAN.

A garden, a perfect mosaic, deep green 'gainst the blackest of loam,
Spread out near a little log cabin—but immaculate home!
I paused to admire—who could help it!—the weedless expanse near the door,
Where, pleased with my pleasured inspection, stood a "mammy" of years that are yore.

"A beautiful garden," I ventured. She cupped a brown hand to her ear. "Fine garden!" I shouted. "Oh sholy! it ought to be fine—I live here!" I went on my way with a sermon as great as I ever had heard. The highest paid preacher existent could never have added a word.

Were every human who cumbers the tiniest spot of the earth To see that the place he inhabits—the work brain or fingers give birth—Stood perfect as e'er he could make it—dear God! what a different sphere! Let's borrow our motto from "mammy"—"It ought to be fine—I live here!"



No. 12. Diagram Showing Space Required for Some Common Outdoor Games.

A REFERENCE LIST OF LITERATURE.

ON LANDSCAPE GARDENING AND HOME FLORICULTURE. BOOKS.

Angiers, Bell Sumner.

The California Book of Gardening.

Published by Paul Elder, San Francisco. Price, \$1.25.

Braunton, Ernest.

The Garden Beautiful in California.

Published by Cultivator Publishing Co., Los Angeles. Price, \$1.00.

Lyon, William S.

Gardening in California.

Published by George Rice & Sons, Los Angeles. Price, \$1.00. Now out of print, but may be found in public libraries.

McLaren, John.

Gardening in California, Landscape and Flower.

Published by A. M. Robertson, San Francisco. Price, \$3.50.

Murmann, Eugene O.

California Gardens.

Published by Eugene O. Murmann, Los Angeles. Price, \$2.00.

Wickson, E. J.

California Garden Flowers, Shrubs, Trees and Vines.

Published by Pacific Rural Press, San Francisco. Price, \$1.50.

Cridland, Robert B.

Practical Landscape Gardening.

Published by A. T. De La Mare Printing and Publishing Co., New York.

Waugh, Frank A.

Rural Improvement.

Published by Orange Judd Company, New York.

Kellaway, Herbert J.

How to Lay Out Suburban Home Grounds.

Published by John Wiley & Sons, New York.

Parsons, S., Jr.

How to Plan the Home Grounds.

Published by Doubleday, Page & Company, Garden City, New York.

Roberts, Isaac Phillips.

The Farmstead.

Published by The MacMillan Company, New York.

MAGAZINES.

California Garden.

Published monthly at San Diego; Editor, Alfred D. Robinson. Price, \$1.00 per year.

Note.—Short articles on California Gardening and Floriculture may be found from time to time in many other magazines and agricultural papers, not mentioned in the list. Many nursery and seed catalogues also, contain a considerable amount of cultural information.

BULLETINS.

Babcock, E. B.

Tree Growing in Public Schools, Circular 59.

Published by College of Agriculture, Agricultural Exp. Station, Berkeley. Free. Now out of print, but may be found in public libraries.

Babcock, E. B.

Suggestions for Garden Work in California Schools, Circular 46. Published by College of Agriculture, Agricultural Exp. Station, Berkeley. Free. Now out of print, but may be found in public libraries.

Essig, E. O.

Injurious and Beneficial Insects of California (2d edition).

Supplement Monthly Bulletin.

Published by California State Commission of Horticulture, Sacramento. Free.

Gregg, J. W., and Stevens, R. T.

Home Floriculture, Correspondence Course 27.

Published by College of Agriculture, Agricultural Exp. Station, Berkeley. Free.

Homans, C. Morris.

Street Highway Planting, Bulletin 4.

Published by California State Board of Forestry, Sacramento. Free.

Smith, R. E. and E. H.

California Plant Diseases, Bulletin 218.

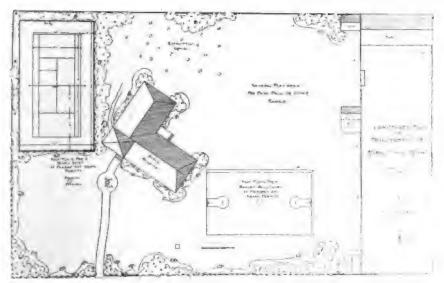
Published by College of Agriculture, Agricultural Exp. Station, Berkeley. Free. Now out of print, but may be found in public libraries.

PLANT MATERIALS FOR SCHOOL GROUNDS IN CALIFORNIA.

By Prof. R. T. Stevens and Miss K. D. Jones, University of California.

No pretensions have been made in compiling the following list to include every plant of desirable ornamental characteristics that is suited to school ground planting in California. Many exotics are being continually introduced, some of which have proved highly satisfactory, while others are little known. The effort has been rather to classify under various subheads those plants which are undoubtedly suited for the purpose indicated and which have proved themselves well adapted to the various sections of the state.

Many of the deciduous ornamental plants commonly employed in the eastern United States for landscape planting have purposely been



No. 13. A school building preventing a satisfactory development because of its incorrect location.

omitted, as they fail to produce the same wonderful spring-flower effects under the different climatic conditions of California. Only such deciduous shrubs as bloom freely and seem to have become more or less adapted to the drier climate of this state are included.

Because of the great variety of climatic and soil conditions throughout the state, it has been necessary to separate the plants into three lists. The first and largest list consists of those plants more or less adapted to all the cultivated areas in the state. The other two lists are supplementary and contain additional plants especially adapted to the central and northern coast counties and that part of southern California in the vicinity of the coast.

TREES MORE OR LESS ADAPTED TO ALL THE CULTIVATED DISTRICTS OF CALIFORNIA.

Shade Trees.—It is often desirable, especially in the warmer districts of the state, to employ trees with wide-spreading habit in the vicinity of school playgrounds. Such trees must be more or less resistant to abuse and poor cultural conditions, and in most cases, should be deciduous to admit sunshine in winter.

Platanus orientalis—European Sycamore.

Ulmus campestris-English Elm.

Castanea sativa—Italian Chestnut.

Morus alba-White Mulberry.

Robinia pseudacacia—Black Locust.

Populus deltoides carolinensis—Carolina Poplar.

Salix babylonica—Weeping Willow.

Quercus agrifolia-Coast Live Oak.

Quercus suber-Cork Oak.

Ficus carica—Common Fig.

Pistacia sinensis-Chinese Pistache.

Lawn Specimens.—The front yard of many school grounds may be further embellished by the careful use of the more ornamental varieties of trees. Such trees furnish little shade but serve to frame the school building and to give height to the border plantations. As a class, they must receive some care and water during the hot summer months.

Pinus canariensis-Canary Island Pine.

Ulmus parviflora—"Chinese Evergreen" Elm.

Magnolia grandiflora.

Cedrus deodara-Deodar Cedar.

Chamæcyparis lawsoniana—Lawson Cypress.

Araucaria bidwillii—Chili Pine.

Cryptomeria japonica—Japanese Cedar.

Libocedrus decurrens-Incense Cedar.

Prunus ilicifolia integrifolia—Catalina Island Cherry.

Prunus atropurpurea—Purple-leaved Plum.

Taxodium distichum—Bald Cypress.

Pittosporum phillyræoides—Weeping Pittosporum.

Street Trees.—Some trees because of their long life, neatness, symmetrical habit, and resistance to abuse, pruning and poor cultural conditions are especially suited to street planting. On straight streets one variety should be used throughout. Great advantages will arise

from the practice of digging large deep holes for each tree and filling in with enriched soil. A freshly planted tree should always be securely staked.

Acacia melanoxylon—Blackwood Acacia.

Eucalyptus polyanthemos—Red Box.

Fraxinus velutina—Arizona Ash.

Ulmus campestris—English Elm.

Ulmus vegeta-Huntington Elm.

Platanus orientalis-European Sycamore.

Acer macrophyllum-Big-leaved Maple.

Somewhat Drought Resistant.—No plant is drought resistant, but many trees have the ability to grow and become more or less ornamental under very adverse cultural conditions of soil and moisture.

Pinus pinea—Italian Stone Pine.

Pinus nigra-Austrian Pine.

Cupressus arizonica—Arizona Cypress.

Cupressus guadalupensis—Blue Cypress.

Olea europæa-Olive.

Eucalyptus viminalis, rostrata, globulus, and polyanthemos.

Quercus suber-Cork Oak.

Acacia decurrens dealbata-Silver Wattle.

Acacia decurrens mollis-Black Wattle.

Casuarina in variety-Beefwood.

Robinia pseudacacia—Black Locust.

Fraxinus velutina—Arizona Ash.

Albizzia julibrissin.

Windbreaks.—Certain trees because of their rapidity of growth, resistance to wind and cold, and adaptability to most soil conditions may be grown closely together to act as windbreaks. They are especially suited if, in addition, they retain their lower branches and foliage as they become older. Trees for this purpose may be placed eight to ten feet apart. It is often advisable to plant a double row with the trees in one row opposite the space between the trees in the other row.

Cupressus macrocarpa—Monterey Cypress.

Pinus radiata-Monterey Pine.

Pinus nigra-Austrian Pine.

Eucalyptus rostrata, viminalis, and polyanthemos.

Populus nigra italica—Lombardy Poplar.

TREES MORE OR LESS ADAPTED TO THE CENTRAL AND NORTHERN COAST COUNTIES OF CALIFORNIA.

Shade.

Ulmus americana—American Elm.

Schinus molle-Pepper Tree.

Arbutus menziesii-Madrone.

Tristania conferta-Brisbane Box.

Quercus rubra-Red Oak.

Liquidambar styraciflua—Sweet Gum.

Celtis australis-Hackberry.

Acer macrophyllum-Big-leaved Maple.

Tilia tomentosa—Silver Linden.

Lawn Specimens.

Maytenus boaria-Mayten.

Corynocarpus lævigatus-New Zealand Laurel.

Cinnamonum camphora—Camphor.

Sterculia diversifolia-Bottle Tree.

Pittosporum undulatum—Victorian Box.

Cratægus-Paul's Double Scarlet Hawthorne.

Betula alba-White Birch.

Sequoia sempervirens-Coast Redwood.

Sequoia gigantea—Big Tree.

Street Trees.

Ulmus americana—American Elm.

Celtis australis—Chinese Hackberry.

Tilia tomentosa—Silver Linden.

Liriodendron tulipifera—Tulip Tree.

Prunus caroliniana-Carolina Cherry.

Robinia pseudacacia decaisneana—Pink-flowering Locust.

Somewhat Drought Resistant.

Sterculia diversifolia-Bottle Tree.

Schinus molle—Pepper Tree.

Tristania conferta—Brisbane Box.

Eucalyptus in variety.

Acacia baileyana and cyanophylla.

Pittosporum crassifolium.

TREES MORE ESPECIALLY ADAPTED TO SOUTHERN CALIFORNIA.

Shade.

Schinus molle—Pepper Tree.
Tristania conferta—Brisbane Box.
Eucalyptus calophylla—White-flowering Gum.
Eucalyptus corynocalyx—Sugar Gum.
Ficus rubiginosa—Rubber Tree.

Lawn Specimens.

Araucaria excelsa—Norfolk Island Pine.
Eucalyptus ficifolia—Scarlet Gum.
Maytenus boaria—Mayten.
Corynocarpus lævigatus—New Zealand Laurel.
Cinnamonum camphora—Camphor.
Sterculia diversifolia—Bottle Tree.
Pittosporum undulatum—Victorian Box.
Pittosporum rhombifolium.
Lagunaria patersonii.

Street Trees.

Lyonothamnus floribundus asplenifolius—Catalina Island Ironwood.

Pittosporum rhombifolium.

Cinnamonum camphora-Camphor.

Somewhat Drought Resistant.

Sterculia diversifolia—Bottle Tree. Schinus molle—Pepper Tree. Tristania conferta—Brisbane Box. Eucalyptus in variety.

EVERGREEN SHRUBS ADAPTED TO ALL THE CULTIVATED DISTRICTS OF CALIFORNIA.

Somewhat Drought Resistant.—In some semi-arid sections of California, it is necessary to use plants that will grow more or less successfully under conditions of severe heat, drought, and neglect. Plants in this list are especially useful in those situations where no attention can be given after the plant is once established.

Acacia in variety.

Pittosporum phillyræoides.

Pittosporum erassifolium.

Photinia arbutifolia—Christmas Berry.

Spartium junceum-Spanish Broom.

Rhamnus californica—Coffee Berry.

Ceanothus in variety-Wild Lilac.

Cytisus in variety—Broom.

Ligustrum in variety—Privet.

Callistemon in variety—Bottlebrush.

Melaleuca in variety—Bottlebrush.

Cistus in variety—Rock Rose.

Parkinsonia aculeata—Jerusalem Thorn.

Nerium oleander-Common Oleander.

Raphiolepis umbellata.

Carpenteria californica.

Ceratonia siliqua—Carob.

Evonymus japonica.

Arbutus unedo—Strawberry Tree.

Leptospermum lævigatus—Australian Tea.

Elæagnus pungens.

Romneya coulteri—Matilija Poppy.

Metrosideros tomentosa.

Prunus ilicifolia—Islay.

Prunus caroliniana—Carolina Cherry.

Rhus integrifolia—Lemonade Berry.

Garrya fremontii—Silk Tassel Bush.

Screens and Hedges.—Many shrubs of a compact habit may be used as hedge plants. There is, however, a fairly well established group of desirable species that lend themselves more easily to training of this kind. Those listed below are used extensively for hedges and have been found to adapt themselves readily to the severe system of trimming and to produce the dense and compact form desired.

Low edgings or boxings (6 to 18 inches).

Berberis darwinii—Darwin's Barberry.

Lonicera nitida—Evergreen Honeysuckle.

Veronica buxifolia.

Myrtus communis var. microphylla—Small-leaved Myrtle.

Evonymus japonica var. microphylla.

Veronica traversii.

Cotoneaster microphylla.

Cistus ladaniferus var. maculatus—Rock Rose.

Small hedges (2 to 6 feet).

Lonicera nitida—Evergreen Honeysuckle.

Berberis darwinii—Darwin's Barberry.

Eugenia apiculata-Luma.

Osmanthus aquifolium var. myrtifolius.

Prunus ilicifolia—Islay.

Pittosporum tenuifolium.

Myrtus communis—Common Myrtle.

Escallonia rubra.

Ligustrum sinense—Chinese Privet.

Ligustrum ovalifolium—California Privet.

Choisya ternata-Mexican Orange.

Pyracantha crenulata—Chinese Evergreen Thorn.

Elæagnus pungens.

Pyracantha angustifolia.

Veronica decussata.

Veronica imperialis.

Veronica elliptica.

Viburnum tinus var. strictum—Erect Laurustinus.

Leptospermum lævigatum—Australian Tea.

Evonymus japonica.

Acacia longifolia.

Acacia armata.

Ceanothos spinosus—Wild Lilac.

High hedges (6 to 12 feet).

Pittosporum tenuifolium.

Pittosporum crassifolium.

Prunus ilicifolia var. integrifolia—Catalina Island Cherry.

Ligustrum ovalifolium—California Privet.

Ligustrum japonicum—Japanese Privet.

Prunus caroliniana—Carolina Cherry.

Escallonia pulverulenta.

Cupressus macrocarpa—Monterey Cypress.

Hakea saligna.

Acacia longifolia.

Acacia melanoxylon-Blackwood Acacia.

Acacia retinodes—(A. floribunda).

Acacia verticillata.

Pyracantha coccinea—Evergreen Thorn.

Spartium junceum—Spanish Broom.

Ground Covers.—There are often banks and slopes where a lawn would be too expensive to maintain and unless covered with green foliage would remain unsightly. Other situations, especially under and between trees and large shrubs, would be materially improved if the ground surface were covered with woody vines and trailing shrubs. It will be necessary to prune out the leader or upright stem of many of these shrubs to encourage their spreading or horizontal growth.

Juniperus chinensis var. procumbens-Prostrate Juniper.

Juniperus sabina var. tamariscifolia-Prostrate Juniper.

Hypericum calycinum—St. John's Wort.

Hypericum moserianum—St. John's Wort.

Myrtus communis-Common Myrtle.

Cotoneaster microphylla.

Cotoneaster horizontalis.

Evonymus radicans.

Leptospermum lævigatum—Australian Tea.

Teucrium fruticans-Germander.

Cistus ladaniferus var. maculatus—Rock Rose.

Evonymus japonica var. viridi-variegata—Duc d'Anjou.

Ornamental Fruits and Berries.—The berried and fruit-bearing ornamental trees and shrubs form one of the most interesting classes of decorative plants. Not only do they produce a flower display throughout the spring and summer months but also add flashes of color for long periods in the fall and winter by their clusters of bright berries or fruits. Only those kinds bearing persistent fruit and of a color contrasting well with green foliage are acceptable in California.

Berried Effects.

Pyracantha coccinea-Evergreen Thorn.

Pyracantha crenulata—Chinese Evergreen Thorn.

Pyracantha angustifolia.

Cotoneaster franchetii.

Cotoneaster horizontalis.

Cotoneaster pannosa.

Cotoneaster acuminata.

Cotoneaster microphylla.

Cotoneaster frigida.

Photinia arbutifolia—Christmas Berry.

Berberis darwinii—Darwin's Barberry.

Arbutus menziesii-Madrone.

Rhamnus californica—Coffee Berry.

Nandina domestica-Sacred Bamboo.

Fruit Effects.

Arbutus unedo-Strawberry Tree.

Aucuba japonica.

Eriobotrya japonica-Loquat.

Feijoa sellowiana-Pineapple Guava.

Choice and Free-Flowering but Requiring Some Irrigation.—Many species of ornamental shrubs are particularly free-flowering in California, while others possess several flowering periods throughout the year. Because of their tendency to bloom in the fall and winter seasons, they are especially useful in the more intensively developed gardens where all-the-year-round effects are desired. It must be understood that in order to obtain the maximum flower effect from the plants in this list, they must receive a fair amount of pruning, irrigation, and cultivation, especially during the summer months, to prepare them for the fall and winter bloom.

Choisya ternata-Mexican Orange.

Veronica in variety.

Polygala dalmaisiana.

Berberis darwinii-Darwin's Barberry.

Escallonia rubra.

Escallonia rosea.

Spartium junceum—Spanish Broom.

Abelia grandiflora.

Cistus ladaniferus var. maculatus—Rock Rose.

Escallonia pulverulenta.

Cytisus racemosus—Genista.

Coronilla glauca—Crown Vetch.

Erica mediterranea—Mediterranean Heath.

Erica melanthera—Cape Heath.

Jasminum humile—Italian Yellow Jasmine.

ADDITIONAL EVERGREEN SHRUBS MORE ESPECIALLY ADAPTED TO THE CENTRAL AND NORTHERN COAST COUNTIES OF CALIFORNIA.

Somewhat Drought Resistant.

Hakea in variety.

Albizzia lophantha.

Myoporum lætum.

Cassia tomentosa.

Cassia artemisioides.

Buddleia in variety.

Coronilla glauca—Crown Vetch.

Dodonæa cuneata.

Dodonæa viscosa.

Malvaviscus mollis-Turk's Cap.

Screens and Hedges.

Low edgings or boxings (6 to 18 inches).

Buxus sempervirens var. suffruticosa—Dwarf Box.

Eugenia myrtifolia.

Myrtus ugni-Chilian Guava.

Veronica carnea.

Erica mediterranea-Mediterranean Heath.

Diosma ericoides-Breath of Heaven.

Small hedges (2 to 6 feet).

Eugenia myrtifolia.

Buxus sempervirens—Common Box.

Taxus baccata—English Yew.

Pittosporum eugenioides.

Grevillea thelemanniana.

Erica in variety-Heath.

Pimelea ferruginea.

High hedges (6 to 12 feet).

Pittosporum undulatum-Victorian Box.

Pittosporum eugenioides.

Hakea suaveolens.

Ground Covers.

Jasminum primulinum.

Sollya heterophylla-Australian Bluebell Creeper.

Trachelospermum jasminoides—(Rynchospermum).

Clianthus puniceus—Parrot's Bill.

Coprosma baueri—New Zealand Looking-glass Plant.

Fuchsia magellanica.

Coronilla glauca—Crown Vetch.

Melaleuca decussata—Bottlebrush.

Lantana sellowiana—Trailing Lantana.

Jasminum humile-Italian Yellow Jasmine.

Ornamental Fruits and Berries.

Myrtus ugni—Chilian Guava.

Ilex aquifolium—English Holly.

Cestrum elegans—(Habrothamnus).

Cestrum aurantiacum.

Eugenia myrtifolia.

Cornus capitata—Evergreen Dogwood.

Choice and Free-Flowering but Generally Requiring Some Irrigation.

Cestrum elegans (Habrothamnus).

Cestrum aurantiacum.

Grevillea thelemanniana.

Fuchsia in variety.

Sollya heterophylla—Australian Bluebell Creeper.

Streptosolen jamesonii-Yellow Heliotrope.

Pimelea ferruginea.

Bouvardia humboldtii.

Iochroma in variety.

Malvaviscus mollis-Turk's Cap.

Tibouchina splendens—(Pleroma).

Plumbago capensis.

Trachelospermum jasminoides—(Rynchospermum).

Cassia tomentosa.

ADDITIONAL EVERGREEN SHRUBS MORE ESPECIALLY ADAPTED TO SOUTHERN CALIFORNIA.

Somewhat Drought Resistant.

Hakea in variety.

Albizzia lopantha.

Myoporum lætum.

Cassia tomentosa.

Cassia artemisioides.

Buddleia in variety.

Coronilla glauca—Crown Vetch.

Dodonæa cuneata.

Dodonæa viscosa.

Malvaviscus mollis—Turk's Cap.

Echium in variety.

Screens and Hedges.

Low edgings or boxings (6 to 18 inches).

Eugenia myrtifolia.

Diosma ericoides—Breath of Heaven.

Jacobinia pauciflora (Libonia).

Small hedges (2 to 6 feet).

Eugenia myrtifolia.

Pittosporum eugenioides.

Atriplex breweri—Salt Bush.

Grevillea thelemanniana.

Aberia caffra—Kei-apple.

Psidium cattleianum—Strawberry Guava.

Lantana—dwarf hybrids.

High hedges (6 to 12 feet).

Pittosporum eugenioides.

Pittosporum undulatum-Victorian Box.

Hakea suaveolens.

Ground Covers.

Jasminum primulinum.

Sollya heterophylla—Australian Bluebell Creeper.

Philadelphus mexicanus—Evergreen Syringa.

Cuphea ignea—Cigar Plant.

Streptosolen jamesonii-Yellow Heliotrope.

Plumbago capensis.

Coprosma baueri-Looking-glass Plant.

Fuchsia magellanica.

Tecoma capensis.

Reinwardtia trigyna—(Linum Flavum) Yellow Flax.

Coronilla glauca—Crown Vetch.

Melaleuca decussata-Bottlebrush.

Lantana sellowiana—Trailing Lantana.

Lantana camara—Common Lantana.

Buddleia madagascariensis.

Solanum rantonnetii.

Ornamental Fruits and Berries.

Duranta plumieri-Golden Dewdrop.

Cestrum elegans—(Habrothamnus).

Cestrum aurantiacum.

Pittosporum rhombifolium.

Pittosporum viridiflorum.

Eugenia myrtifolia.

Cornus capitata—Evergreen Dogwood.

Psidium in variety-Guava.

Choice and Free-Flowering but Requiring Some Irrigation.

Cestrum elegans (Habrothamnus).

Cestrum aurantiacum.

Grevillea thelemanniana.

Lantana in variety.

Fuchsia in variety.

Sollya heterophylla—Australian Bluebell Creeper.

Streptosolen jamesonii—Yellow Heliotrope.

Genista monosperma-White Broom.

Statice in variety.

Reinwardtia trigyna—(Linum Flavum). Yellow Flax.

Iochroma in variety.

Jacobinia pauciflora—(Libonia).

Duranta plumieri-Golden Dewdrop.

Cassia artemisioides.

Cuphea in variety.

Philadelphus mexicanus—Evergreen Syringa.

Tibouchina splendens—(Pleroma).

Plumbago capensis.

Cassia tomentosa.

Hibiscus in variety.

Tecoma capensis.

Tecoma smithii.

DECIDUOUS SHRUBS FOR CALIFORNIA.

Somewhat Drought Resistant.

Tamarix in variety-Tamarisk.

Chænomeles japonica-Japanese Quince.

Punica granatum-Pomegranate.

Evonymus europæa-Spindle Tree.

Rhus cotinus-Smoke Tree.

Ornamental Fruits and Berries.

Berries.

Elæagnus multiflora-Gumi.

Symphoricarpos albus—Snowberry.

Symphoricarpos vulgaris—Indian Currant.

Cratægus cordata—Washington Thorn.

Berberis vulgaris—Common Barberry.

Sambucus racemosa—Elderberry.

Fruits.

Evonymus europæa-Spindle Tree.

Ribes speciosum—Fuchsia-flowered Gooseberry.

Punica granatum—Pomegranate.

Diospyros kaki-Japanese Persimmon.

Free Blooming—Especially Desirable for Early Spring Flower Effects.

Chænomeles japonica-Japanese Quince.

Deutzia in variety.

Diervilla Eva Rathke (Weigela).

Diervilla Van Houttei.

Exochorda grandiflora—Pearl Bush.

Hibiscus syriacus—Rose of Sharon.

Kerria japonica-Japanese Rose.

Lagerstræmia indica-Crape Myrtle.

Lonicera tatarica—Tartarian Honeysuckle.

Magnolia liliflora-Deciduous Magnolia.

Magnolia soulangeana.

Magnolia stellata.

Pæonia suffruticosa (P. moutan)—Tree Peony.

Philadelphus in variety—Mock Orange.

Prunus japonica—Dwarf Flowering Almond.

Prunus mume-Flowering Apricot.

Prunus serrulata—Japanese Flowering Cherry.

Prunus persica—Flowering Peach.

Pyrus floribunda—Japanese Flowering Apple.

Pyrus spectablis-Chinese Flowering Apple.

Punica granatum nana—Dwarf Pomegranate.

Ribes aureum—Yellow Flowering Currant.

Ribes sanguineum—Red Flowering Currant.

Spiræa cantoniensis—Bridal Wreath.

Spriræa prunifolia.

Spiræa thunbergii.

Spiræa van houttei.

Syringa-Lilac.

S. vulgaris alba-Common White Lilac.

S. vulgaris purpurea—Common Purple Lilac.

Grafted varieties.

Tamarix hispida æstivalis—Summer Flowering Tamarisk.

Tamarix parviflora—Spring Flowering Tamarisk.

Viburnum opulus sterile—Common Snowball.

Viburnum tomentosum plicatum—Japanese Snowball.

VINES MORE OR LESS ADAPTED TO ALL OF THE CULTIVATED DISTRICTS OF CALIFORNIA.

Vines for Brick, Stone or Plaster Surfaces.—Because of their various ways of clinging to rough surfaces, these vines require no support. They should not be grown on wood or surfaces which are to be painted.

Bignonia Unguis-cati (B. tweediana).

- D Boston Ivy—Parthenocissus tricuspidata (Syn. Ampelopsis). Creeping Fig—Ficus pumila—A little tender.
- D Chinese Trumpet Creeper—Campsis chinensis (Syn. Tecoma grandiflora).

Creeping Fig, Small-leaved—Ficus pumilá var. minima—A little tender.

D Deciduous.

D Cross Vine-Bignonia capreolata.

English Ivy-Hedera helix.

Evonymus radicans.

- D Trumpet Creeper—Campsis radicans (Syn. Tecoma radicans).
- D Virginia Creeper—Parthenocissus quinquefolia (Syn. Ampelopsis).

Vines for School Buildings.—Vines are most ornamental when they merely decorate or partially screen the outside surface of buildings. Their chief purpose is to soften hard architectural lines of walls, corners and window frames. They should be strongly supported by wire, wire netting, or some form of trellis, and should never be allowed to produce thick unsightly masses of stems and leaves near the top of the support. Systematic thinning, by removing old wood, and proper training are necessary if the vine is not to become a nuisance.

Asparagus plumosus.

Australian Pea Vine-Dolichos lignosus.

Bignonia Unguis-cati (B. tweediana).

D Boston Ivy—Parthenocissus tricuspidata (Syn. Ampelopsis). Creeping Fig—Ficus pumila.

Creeping Fig, Small-leaved—Ficus pumila var. minima.

D Dutchman's Pipe-Aristolochia macrophylla.

Evonymus radicans.

Hall's Honeysuckle-Lonicera japonica var. Halliana.

English Ivy-Hedera helix.

Jessamine—Jasminum officinale.

Lonicera japonica var. chinensis.

Maiden-hair Vine-Muehlenbeckia complexa.

Potato Vine-Solanum jasminoides.

Roses.

- D Virginia Creeper—Parthenocissus quinquefolia (Syn. Ampelopsis).
- D Wistaria, Japanese—Wistaria multijuga.
- D Wistaria, White Japanese—Wistaria multijuga alba.

Vines for Fences.—Many vines, somewhat resistant to neglect and producing dense foliage near the ground, may be successfully employed on fences of wood or wire netting to form a hedge-like growth. Such vines should not produce heavy bunchy growths which would necessitate considerable pruning and attention.

Akebia quinata.

Bignonia Unguis-cati (B. tweediana).

- D Chilean Jasmine-Mandevilla suaveolens.
- D Clematis montana.

p Deciduous.

- D Clematis paniculata.
- D Cross Vine-Bignonia capreolata.

Creeping Fig-Ficus pumila.

Creeping Fig, Small-leaved-Ficus pumila var. minima.

D Dutchman's Pipe—Aristolochia macrophylla.

English Ivy-Hedera helix.

Evonymus radicans.

German Ivy-Senecio mikanioides.

D Grapes, California Wild.

Hop, Common—Humulus lupulus.

Hop, Japanese—Humulus japonicus, annual.

Jessamine-Jasminum officinale.

Jasminum primulinum.

D Kudzu Vine—Pueraria hirsuta (thunbergiana).

Maiden-hair Vine-Muehlenbeckia complexa.

Nasturtium-Tropœlum majus, annual.

Parrot's Bill-Clianthus puniceus.

Passion Vine—Passiflora cærulea.

D Perennial Pea-Lathyrus latifolius.

Plumbago capensis.

Pride of California—Lathyrus splendens.

Scarlet Runner Bean-Phaseolus multiflorus, annual.

Star Jasmine—Trachylospermum jasminoides.

Sweet Pea-Lathyrus odorata, annual.

Trailing Lantana-Lantana sellowiana.

- virginia Creeper—Parthenocissus quinquefolia (Syn. Ampelopsis).
- D Wild Cucumber—Echinocystus lobata.

Vines for Porches, Pergolas and Arbors.—Certain tall growing vines are best exhibited by providing support some distance above the ground. Those of medium growth, effective flowers, and somewhat pendant foliage are most suitable. Such vines should be trained around the posts or pillars of the pergola and not be allowed to cover the architectural outlines too densely.

Akebia quinata.

Australian Pea Vine-Dolichos lignosus.

Balsam Apple-Momordica balsamina, annual.

- D Cross Vine-Bignonia capreolata.
- D Chilean Jasmine—Mandevilla suaveolens.
- D Clematis montana.
- D Clematis paniculata.
- D Dutchman's Pipe—Aristolochia macrophylla. English Ivy—Hedera helix.

D Deciduous.

D Grapes (Vitis).

Common Wild Grape.

Pierce, dark foliage, black grapes.

Rose Sultaniana, light foliage, pink grapes.

Golden Queen, dark green foliage, white grapes.

Hall's Honeysuckle—Lonicera japonica var. Halliana.

Jessamine-Jasminum officinale.

Lonicera japonica var. chinensis.

Maiden-hair Vine-Muehlenbeckia complexa.

Passion Vine-Passiflora cærulea.

Potato Vine-Solanum jasminoides.

Roses.

Scarlet Runner Bean-Phaseolus multiflorus, annual.

- D Virginia Creeper—Parthenocissus quinquefolia (Syn. Ampelopsis).
- D Wistaria, Japanese—Wistaria multijuga.
- D Wistaria, White Japanese-Wistaria multijuga alba.

Vines for Screening Purposes.—It is often desirable to erect a more or less dense screen between various landscape features or to hide the unsightly walls of outbuildings. A trellis fence or support of wood or wire upon which can be grown twining vines with a dense compact habit is most satisfactory.

Akebia quinata.

Balsam Apple-Momordica balsamina, annual.

- D Cross Vine-Bignonia capreolata.
- D Dutchman's Pipe—Aristolochia macrophylla.

English Ivy-Hedera helix.

Evonymus radicans.

German Ivy-Senecio mikanioides.

D Grapes.

Hall's Honeysuckle-Lonicera japonica var. Halliana.

D Hop, Common—Humulus lupulus.

Jasminum primulinum.

Jessamine—Jasminum officinale.

Lonicera japonica var. chinensis.

Madeira Vine—Boussingaultia baselloides.

Maiden-hair Vine-Muehlenbeckia complexa.

Nasturtium—Tropæolum majus, annual.

Passion Vine-Passiflora cærulea.

p Polygonum baldschuanicum.

Potato Vine-Solanum jasminoides.

Star Jasmine—Trachylospermum jasminoides.

Trailing Lantana—Lantana sellowiana.

D Wild Cucumber—Echinocystis lobata.

p Deciduous.

ADDITIONAL LIST OF VINES ESPECIALLY ADAPTED TO THE COAST COUNTIES AND SOUTHERN CALIFORNIA.

Vines for Stone, Brick or Cement.

- D Climbing Snowball—Decumaria barbara.
- * Clytostoma purpureum (Syn. Bignonia purpurea). Phædranthus buccinatorius (Bignonia cherere; B. buccinatoria).

Vines for Buildings.

Catalonian Jasmine-Jasminum grandiflorum.

Clytostoma callistegioides—(Bignonia speciosa).

* Clytostoma purpureum (Syn. Bignonia purpurea).

Evergreen Ampelopsis—Cissus striata.

Evergreen Grape—Vitis capensis.

Evergreen Trumpet Creeper-Phædranthus buccinatorius (Syn. Bignonia cherere or B. buccinatoria).

Hardenbergia Comptoniana (Syn. Kennydia comptoniana).

Hedera helix var. chrysocarpa.

Jasminum azoricum.

Jasminum rigidum (Syn. J. ligustrifolium).

Jasminum simplicifolium.

Pandorea jasminoides (Tecoma jasminoides).

Pyrostegia venusta—(Bignonia venusta).

- * Stauntonia hexaphylla.
- * Vitis antarctica (Syn. V. baudiniana).
- * Vitis hypoglauca—(Cissus hypoglauca). Vitis rhombifolia (Syn. Cissus rhombifolia).

Vines for Fences.

Australian Bluebell Creeper-Sollya heterophylla.

Balloon Vine—Cardiospermum hirsutum.

Cup and Saucer Vine-Cobæa scandens.

Evergreen Ampelopsis—Cissus striata (Vitis striata).

Evergreen Mock Orange—Philadelphus mexicanus.

Evergreen Trumpet Creeper—Phædranthus buccinatorius (Syn. Bignonia cherere or B. buccinatoria).

Hardenbergia Comptoniana.

Jasminum gracillimum.

Kennedya rubicunda.

Lantana camara.

Lily of the Valley Vine—Salpichroa rhomboidea.

Lonicera confusa.

Deciduous.

Southern California.

Pandorea australis—(Tecoma australis).

Pandorea jasminoides—(Tecoma jasminoides).

* Passiflora edulis.

Passiflora mollissima.

* Passiflora racemosa (princeps).

Pithecoctineum muricatum.

• Queen of Sheba—(Pandorea Brycei).

* Rhynchosia minima.

Streptosolen jamesonii.

Swainsona galegifolia.

Vitis capensis.

* Vitis hypoglauca.

Vines for Porches, Pergolas and Arbors.

- * Bougainvillea glabra var. Sanderiana.
- * Clytostoma purpureum (Syn. Bignonia purpurea).
- * Dioclea glycinoides.

Evergreen Ampelopsis—Cissus striata.

Evergreen Wistaria-Milletia megasperma.

Jasminum azoricum.

Jasminum rigidum (Syn. ligustrifolium).

- * Jasminum nitidum.
- * Lonicera confusa.

Pandorea australis—(Tecoma australis).

* Pandorea Brycei (Tecoma, Queen of Sheba).

Pandorea Jasminoides—(Tecoma jasminoides).

Passifilora manicata.

Phædranthus buccinatorius (Bignonia cherere or B. buccinatoria).

Pithecoctineum muricatum.

Pyrostegia venusta—(Bignonia venusta).

- Solanum wendlandii.
- * Stigmaphyllon ciliatum.
- * Stigmaphyllon littorale.
 Tecoma capensis.

Vines for Screening.

Australian Bluebell Creeper-Sollya heterophylla.

Clytostoma callistegioides—Bignonia speciosa.

Cup and Saucer Vine—Cobra scandens.

Dioclea glycinoides.

Evergreen Ampelopsis—Cissus striata (Syn. Vitis striata).

Evergreen Mock Orange—Philadelphus mexicanus.

[·] Southern California.

Jasminum azoricum.

- * Kennedya rubicunda.
- * Lonicera confusa.

Pandorea australis—(Tecoma australis).

Passiflora manicata—(Tacsonia manicata).

Pithecoctineum muricatum.

- * Rhynchosia minima.
- * Vitis antarctica.

Vitis capensis.

Vitis rhombifolia.

PERENNIAL HERBS.

This is not intended to be a complete list of the herbs of California but is suggestive merely. The botanical names are added as a means of obtaining further information from encyclopedias or other reference books.

Anchusa italica var. Dropmore.

Baby breath—Gypsophila paniculata.

Balloon Flower-Platycodon grandiflorum.

Begonias.

Bidens ferulæfolia.

Bleeding Heart-Dicentra spectabilis.

Blue Marguerite—Felicia amelloides.

Butterfly Weed-Asclepias tuberosa.

Candytuft-Iberis sempervirens.

California Fuchsia—Zauschneria californica.

Campanulas in variety.

Cardinal Flower—Lobelia cardinalis.

Centaurea babylonica.

Chænostoma hispidum.

Chrysanthemum coccineum (Syn. Pyrethrum roseum).

Columbines—Aquilegias.

Common Thyme—Thymus vulgaris.

Coral Bells-Heuchera sanguinea.

Coreopsis lanceolata.

Coreopsis maritima (Syn. Leptosyne maritima).

Daisy, English—Bellis perennis.

Evening Primrose-Oenothera californica.

False Alum Root—Heuchera micrantha.

False Dragonhead—Physostegia virginiana.

Flax-Linum monogynum.

Forget-Me Not-Myosotis, not suited to some parts of southern California.

[•] Southern California.

Four o'Clock-Mirabilis jalapa.

Fringe Cups-Tellima grandiflora.

Gaura Lindheimeri.

Gazania splendens.

Geum coccineum, Mrs. Bradshaw.

Golden Glow-Rudbeckia laciniata.

Golden Rod-Solidago.

Golden-tuft-Alyssum saxatile.

Hardy Gloxinia-Incarvillea Delavayi.

Helichrysum petiolatum (Syn. Gnaphalium lanatum).

Honeybells-Mahernia verticillata.

Iris.

Japanese Wind Flower-Anemone japonica.

Leopard Plant-Senecio Kaempferi var. aureo-maculatus.

London Pride-Saxifraga umbrosa.

Madagascar Periwinkle—Vinca rosea.

Maltese Cross-Lychnis chalcedonica.

Marguerite—Chrysanthemum frutescens.

Mexican Daisy—Erigeron mucronatus.

Mosquito Flower-Lopezia albiflora.

Moss Pink-Phlox subulata.

Mouse Ear-Cerastium tomentosum.

Nierembergia gracilis.

Othonna crassifolia (Syn. O. capensis).

Pæony-Pæonia.

Pentstemon gloxinioides.

Perennial Flax-Linum perenne.

Perennial Phlox—Phlox paniculata.

Pheasant's Eye Pink—Dianthus plumarius.

Poppy, Hunnemann's—Hunnemannia fumariæfolia.

Poppy, Iceland—Papaver nudicaule.

Poppy, Oriental—Papaver orientale.

Primrose—Primula.

Purple Rock Cress-Aubretia deltoidea var. graeca.

Redwood Ivy—Vancouveria hexandra.

Redwood Sorrel-Oxalis oregana.

Rehmannia angulata.

Rudbeckia speciosa.

Salvia azurea var. grandiflora (Syn. S. pitcheri).

Salvia leucantha.

Salvia patens.

Salvia splendens-Scarlet Sage.

Saxifrage Saxifraga crassifolia.

Scabiosa caucasica.

Sea Pink-Armeria vulgaris.

Shasta Daisy-Chrysanthemum.

Shrubby Calceolaria—Calceolaria integrifolia (Syn. C. rugosa).

Snapdragon-Antirrhinum majus.

Snow-on-the-Mountain-Arabis alpina.

Sunflower-Helianthus.

Sun Rose-Helianthemum chamaecistus mutabile.

Stock (Matthiola).

Stokes' Aster-Stokesia cyanea.

Strawberry Geranium; Old Man's Beard—Saxifraga sarmentosa.

Sweet William-Dianthus barbatus.

Sweet Woodruff-Asperula odorata.

Tall Cup-Flower-Nierembergia frutescens.

Touch-Me-Not-Impatiens sultani.

Transvaal Daisy-Gerbera jamesonii.

Valerian-Centranthus ruber.

Verbena hybrida.

Violet-Viola odorata.

Wallflower—Cheiranthus cheiri, not suited to some parts of southern California.

Wandering Jew-Tradescantia Virginiana.

White-Cup-Nierembergia rivularis.

Wild Buckwheat-Eriogonum fasciculatum.

Woolly Woundwort-Stachys lanata.

Yellow Globe Flower—Trollius europæus.

ANNUALS, OR TREATED AS SUCH.

While it is not advisable to use annuals only in our gardens because of their transitory nature, still they are very useful to produce quick temporary effects, to fill empty spaces in the perennial border, to use at the feet of bulbs that have finished blooming, or to sow in vacant lots.

African Orange Daisy-Dimorphotheca aurantiaca.

Ageratum mexicanum.

Anchusa capensis, biennial.

Annual Baby Breath-Gypsophila elegans.

Annual Larkspur—Delphinium consolida.

Annual Phlox-Phlox Drummondii.

Arctotis breviscapa.

Arctotis grandis.

Baby Blue-Eye-Nemophila menziesii (Syn. N. insignis).

Balsam—Impatiens balsomina.

Bird's-eyes-Gilia tricolor.

Blazing Star-Mentzelia lindleyi.

Browallia grandiflora—(B. roezlii).

Browallia speciosa major.

California Fuchsia—Zauschneria californica.

California Poppy—Eschscholtzia californica, sometimes perennial.

California Wild Flowers.

Canterbury Bells-Campanula medium, biennial.

Chinese Lantern Plant—Physalis Franchetii, said to be annual, biennial or perennial.

Chrysanthemum, annual.

Morning Star.

Evening Star.

Chrysanthemum tricolor.

Clarkia elegans.

Clarkia pulchella.

Cockscomb—Celosia.

Collinsia bicolor.

Coreopsis Stillmani (Syn. Leptosyne Stillmani).

Coreopsis tinctoria (Syn. Calliopsis). Use Coreopsis coronata instead of this in southern California.

Cornflower-Centaurea cyanus.

Cosmos.

Cream Cups-Platystemon californicus.

Eucharidium Breweri.

Everlasting Flowers-Helichrysum bracteatum.

Farewell to Spring-Godetia grandiflora.

Forget-Me-Not-Myosotis.

Gaillardia pulchella var. picta.

Garden Pink—Dianthus chinensis var. Heddewigii.

Gilias.

Glaucium hybrida, so called.

Globe Amaranth—Gomphrena globosa.

Helipterum Manglesii (Syn. Rhodanthe).

Hollyhock, both annual and perennial.

Honesty-Lunaria annua.

Indian Paint Brush—Castilleja californica.

Linaria maroccana.

Lobelia compacta.

Lobelia gracilis.

Lobelia tenuior.

Love-in-a-Mist—Nigella damascena.

Lupine, Dwarf Blue-Lupinus affinis.

Marigold, African—Tagetes erecta.

Marigold, French-Tagetes patula.

Mignonette-Reseda odorata.

Moss Rose—Portulaca grandiflora.

Mourning Bride—Scabiosa atropurpurea.

Navelwort—Omphalodes linifolia.

Nemesia compacta—Blue Gem.

Nemesia stumosa var. Suttoni.

Nicotiana alata var. grandiflora (Syn. N. affinis).

Phacelia Parryi.

Pink Gentian—Erythræa venusta.

Pot Marigold-Calendula officinalis.

Prickly Poppy-Argemone platyceras.

Salpiglossis sinuata.

Sanvitalia procumbens.

Sanvitalia procumbens, flore pleno.

Scarlet Flax-Linum grandiflorum var. coccineum.

Schizopetalon walkeri.

Shirley Poppy—some form of Papaver Rheas.

Silene pendula.

Spotted Baby Blue-eye-Nemophila maculata.

Statice suworowi.

Sunflower-Helianthus annuus.

Sunshine—Bæria gracilis.

Sweet Alyssum—Alyssum maritimum.

Sweet Sultan-Centaurea moschata.

Tidy Tips—Layia elegans.

Torenia Fournieri.

Venus Looking Glass-Specularia speculum.

Whispering Bells-Emmenanthe penduliflora.

Wild Canterbury Bell—Phacelia Whitlavia.

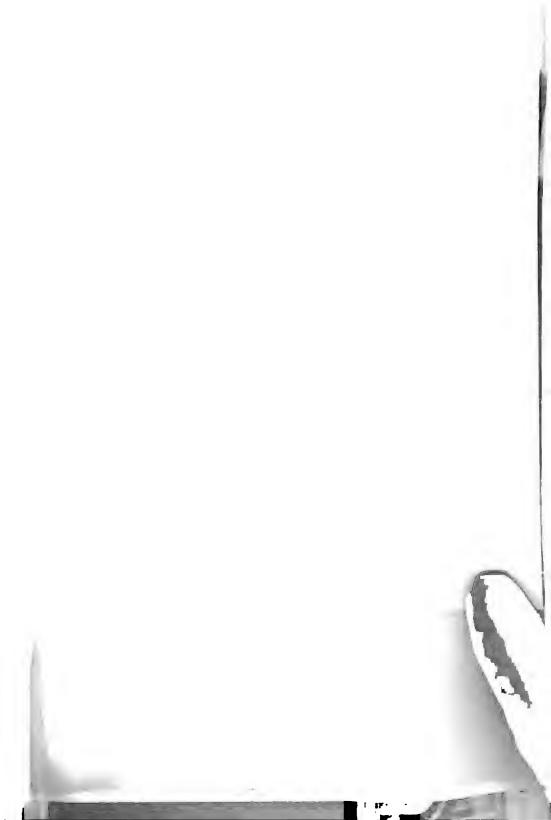
Yellow Violet—Viola pedunculata.

The President and Regents
of the
University of California
request the honour of your presence at
the Exercises in Dedication of
Hilgard Hull
on Saturday, the thirteenth of October
nineteen hundred and seventeen
Berkeley, California



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UNIVERSITY OF CALIFORNIA BERKELEY

DEDICATION OF HILGARD HALL

10 A.M., SATURDAY, OCTOBER 13, 1917

EUCALYPTUS GROVE, SOUTH OF HILGARD HALL

PRESIDENT BENJAMIN IDE WHEELER, Presiding

ORDER OF EXERCISES

"Agriculture in California During Hilgard's Time"

Hon. W. MAYO NEWHALL

President, Board of Trustees, Stanford University,

San Francisco

"The Railroad and the Farmer"

WILLIAM BENSON STOREY, Esq., '81

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"Solid Foundations"

Hon. PETER J. SHIELDS

Judge of the Superior Court, Sacramento

"Hilgard as I Knew Him"

W. B. Wellman, Esq., Ex-'86

President, Wellman, Peck & Company, San Francisco

"Carrying Hilgard's Work Forward"

Dr. THOMAS FORSYTH HUNT

Dean of the College of Agriculture, University of California

Presentation by President Wheeler of Badges to Agriculture Club Prize Winners

INTERMISSION

- 1:00 to 2:30 P.M.
 - Inspection of Hilgard Hall, the students of the College of Agriculture acting as hosts.
- 2:30 to 3:30 P.M.

Conferences of divisions located in Hilgard Hall.

(a) Agronomy

Room 123

Presiding: JOHN W. GILMORE, Professor of Agronomy.
Discussion of California's Agronomic Problems led by:
R. L. Adams, P. B. Kennedy, B. A. Madson, W. W.
Mackie, G. W. Hendry, J. W. Gilmore.

(b) Citriculture

Room 339

Presiding: J. ELIOT COIT, Professor of Citriculture.
Discussion led by: George T. Roeding, Fresno; William
T. Kirkman, Jr., Fresno; F. O. Popenoe, Altadena;
D. W. Coolidge, Pasadena; F. H. Wilson, Fresno.

(c) Forestry

Room 115

Presiding: WALTER MULFORD, Professor of Forestry. Discussion led by:

Roy Headley, District Forester, San Francisco, "Fire Protection Scheme for California Counties."

- Charles L. Trabert, Assistant Secretary, Coos Bay Lumber Company, San Francisco, "What the Lumbermen Expect of the Division of Forestry."
- C. E. Bachford, Assistant District Forester, San Francisco, "Importance of Grazing on the National Forests of California."
- G. M. Homans, State Forester, Sacramento, "The Future of Forestry in California."

(d) Genetics

Boom 201

Presiding: E. B. BABCOCK, Professor of Genetics. Conference on Seed Selection:

- S. S. Rogers, Assistant Professor of Olericulture, University Farm, "Some Results of Seed Selection."
- O. L. Coulter of C. C. Morse and Company, "Roguing Problems as Related to Commercial Seed Production."
- W. E. Packard, Assistant Professor of Agronomy, "What the Farm Advisers are Doing."
- General Discussion led by: Professor H. J. Webber, Director Citrus Experiment Station, Biverside, and H. A. Hyde, potato seed grower of Watsonville, California.

(e) Pomology

Boom 217

Presiding: W. L. Howard, Associate Professor of Pomology. Discussion by: G. H. Hecke, State Commissioner of Horticulture, for the fruit growers of the state; W. G. Alexander, California Prune and Apricot Growers, Inc., for the dried fruit interests of the state; C. B. Bills, Pioneer Fruit Company, of Sacramento, for the freah fruit shipping interests of the state; C. Thorpe, Manager of California Walnut Growers' Association, for the nutgrowers of the state; A. L. Wisker, Proprietor Loma Rica Nurseries, Grass Valley, for the nurserymen of the state; C. W. Hunt, commission merchant of San Francisco. for the commission merchant of San Francisco.

(f) Soil Technology

Boom 24

Presiding: CHARLES F. SHAW, Professor of Soil Technology.

Discussion of Land Classification and Valuation led by: Clyde M. Seavey, Chairman, State Board of Control; Freeman H. Bloodgood, Commissioner of Beal Estate; Russel Bunnell, Assessor Lassen County.

(g) Viticulture

Room 216

Presiding: F. T. BIOLETTI, Professor of Viticulture.

Discussion of the problems of the growing of raisin, wine, and table grapes and of olive growing and the preservation of fruit and vegetables led by: E. M. Sheehan, Secretary State Commission of Viticulture; Frank T. Swett, Horticultural Commissioner of Contra Costa County, and James Madison, of the Associated Raisin Company.

- 3:30 P.M. Closing session of the Convention of the California Nurserymen's Association. Room 125.
 - (a) The Need of Improvement in Tree Fruits. Leonard Coates.
 - (b) The Vital Question in Improving Tree Fruits by Bud Selection. E. B. Babcock.
 - (c) Bud Selection and the Recording of Nursery Stock. J. Eliot Coft.
- 10:00 A.M. to 5:00 P.M. Exhibits of Citrus and Semi-tropical Fruits. Room 215.
- 10:00 A.M. to 5:00 P.M. Exhibits of New Plant Creations. Room 209.

All interested will be welcome at all the conferences and exhibits of the day.

UNIVERSITY OF CALIFORNIA COLLEGE OF AGRICULTURE BERKELEY

HILGARD HALL



MAIN FAÇADE OF HILGARD HALL

A GIFT OF THE CITIZENS OF CALIFORNIA
DEDICATED SATURDAY, OCTOBER THE THIRTEENTH
NINETEEN HUNDRED AND SEVENTEEN



A DETAIL FROM THE MAIN ENTRANCE

HILGARD HALL

N a slight eminence facing the Golden Gate stands Hilgard Hall, a fitting monument to the memory of the man whose name it bears and whose indefatigable energy and wise forethought made its realization possible, Eugene Woldemar Hilgard. Called to California early in 1875 Professor Hilgard established the first agricultural experiment station in the United States at the University of California. Serving for thirty years as Director and for more than forty years as professor in the University, his contributions to agricultural science and his influence on the development of agricultural pedagogy can hardly be overestimated. The firm stand taken by him with reference to the dignity and pedagogical value of agricultural science at this early period, when so many institutions, now great, were in their formative periods, has exerted a profound influence upon the development of agricultural education. Indeed, the high place modern scientific agriculture holds is in no small way due to the efforts of Professor Hilgard, and it is not too much to say that the splendid facilities possessed by the College of Agriculture of the University of California, represented in our two new buildings, are the direct result of his foundation work done under most trying conditions in the early years of the life of the institution.

Hilgard Hall is a gift of the people of California, the funds for its erection being appropriated by the Regents from the \$1,800,000 bond issue provided by the initiative vote of the people in 1914. It cost \$350,000 and contains equipment to the value of \$25,000 additional. It was erected according to schedule, being commenced August 1, 1916, and occupied early in August, 1917.

Hilgard Hall comprises the second of the three buildings which will complete the agricultural quadrangle ac-

Prepared by ROBERT W. HODGSON.

cording to the Phoebe Hearst architectural plan for the development of the University. The idea underlying the quadrangle composed of the agricultural buildings, as developed by the architect, Professor John Galen Howard, was taken from the old Tuscan farm with its inner court of activity. The two present buildings complete half of the court. The desire for a court, coupled with the existing contours have given to Hilgard Hall a special form, the building having four distinct turnings. The principal façade, about 180 feet in length, faces the west and is treated with a colonnade of ten massive pillars, surmounted by an attic wall on which occurs the following inscription: "To Rescue for Human Society the Native Values of Rural Life," typifying the aim of the institution.

The building is constructed of reinforced concrete with a light gray plaster finish, and is approximately sixty feet in width by three hundred feet in length. It is roofed in tile and in arrangement and appearance is of the same general type as all the newer buildings on the Campus, having three main floors and a basement floor. It contains 111 rooms, of which ninety-five are devoted to offices, classrooms, and laboratories, the remainder being given over to machinery, lavatories, and janitors' quarters.

The main entrance is by the west through a door decorated by a conventionalized California poppy and carrying the agricultural symbols of plenty, the basket of fruit and the overflowing cornucopia. A unique feature of the building is the exterior decoration in colors obtained by the use of Sgraffito work. The pilasters terminating the colonnade and at all the corners of the building, the main frieze, as well as certain panels and wall surfaces are decorated with this work. Sgraffito is an Italian method of decoration, giving a cameo effect by means of sculptured colored layers of plaster one over the other. The ornamental design in general is taken from symbolic forms of agricultural life, such as the sheaf of wheat, the flail and basket, the bull's head, and fruit and flowers.



DECORATIVE DESIGN, NORTH ENTRANCE

The building contains four unassigned general lecture rooms, two on each of the first and second floors, with seating accommodations for 428 students at one time. In addition it contains a Conversation Room (102) and two rooms for the use of student organizations (328, 329). A unique feature of the building is the two garden courts situated on the top floor immediately behind the attic wall. These are provided with window seats and when decorated with hanging vines and potted plants will be both useful and ornamental additions to the top floor. From these courts access can be had to the roof, from which there is a very fine view.

The rest of the building is divided among the seven following divisions: Agronomy (dealing with field and forage crops, crop production, and farm management). Citriculture (covering all phases of citrus, semi-tropical, and tropical fruit production). Forestry (offering complete courses in general forestry, forest utilization, silviculture, mensuration, technology, and forest management), Genetics (dealing with the application of the principles of breeding to plants and animals). Pomology (offering courses covering all phases of the production of deciduous fruits, small fruits, and nuts). Soil Technology (dealing with methods of soil management, soil mapping, physical analysis, and soil physics), and Viticulture (covering the subjects of grape growing, olive growing, winemaking, food preservation, and fermentation).

The third, or top floor is devoted entirely to offices with a few exceptions, which will be noted elsewhere. In addition, a certain number of offices are situated in individual research laboratories in various parts of the building. There are thirty-three offices on the top floor.

The basement, first, and second floors are devoted to lecture rooms, classrooms, and laboratories, the basement being divided between the divisions of Agronomy, Citriculture, Forestry, Pomology, and Soil Technology. The north half of the first floor is occupied by Forestry and the south

half by Agronomy. The second floor is utilized by Pomology, Citriculture, Viticulture, and Genetics.

The administrative officers (307-310) are at **AGRONOMY** the north end of the top floor. In addition there is a Seed Laboratory conducted in co-operation with the U.S. Department of Agriculture (311). Other offices of the division are located in connection with private re-The laboratories and classrooms occusearch laboratories. pied by this division comprise a large general Student Laboratory accommodating fifty-six students (116), a commodious Preparation Room (118), Seed Collection and Herbarium Rooms (119, 120), a Research Laboratory and Office (122), and a Seminar Room (124). Located on the basement floor immediately beneath the Agronomy quarters is a large Receiving Room (23) for the storage and treatment of bulky material, and a Fumigating Room (23), hermetically sealed and so equipped with fans and blowers that fumigation even with the most poisonous gases can be done with safety.

Special features of the equipment possessed by the Agronomy Division are the fine seed collection (119), the herbarium of several thousand specimens of crop plants (120), an excellent collection of fibers and fiber crops (116), and the full and complete set of standards or guides used in systematic work (116).

The seed collection is considered one of the best, if not the best, in the United States. A set of standards to which to refer in describing field and forage crops is of great value and the collection here is very complete and represents an exhaustive study of many hundreds of varieties.

The officers of this Division (338-40) are located on the west side of the top floor. opening on the south garden court. In the main office is located a very complete set of photographs concerning eitrus and semi-tropical fruits.

The laboratories and class rooms are situated on the second floor and consist of a Research Laboratory (214) and a large general Student Laboratory (215). On the basement floor, adjoining the Agronomy Room, is a spacious Workroom (21). Here is displayed a large collection of orchard heaters and provision is made for the establishment of a small olive processing works. In the student laboratory is a small hydraulic press which is used to illustrate the process of making olive oil. Here also is a good herbarium of specimens of citrus and semi-tropical fruits and foliage.

The research laboratory is devoted to studies on the application of the principles of plant physiology to the problems of citrus and semi-tropical fruit production, a subject as yet little investigated, but one of fundamental importance.

This Division occupies six offices (301–306). FORESTRY facing the west and opening on the north gar-The north half of the first floor is given over den court. to forestry and contains a fine large General Laboratory for student work (115), as well as research laboratories for each of the five departments of forestry: Technology. Forest Management, Mensuration, Silviculture, and Utilization. In addition, there is a spacious Filing Room (103), where over 10,000 lantern and microscope slides are kept, a large Logging Room (104), an Instrument Room (109), a Draughting Room (110), provided with a dark and blue-print room (111), a specially equipped Herbarium Room (113), and a large Storage Room (114). basement floor there is a Machinery and Wood Demonstration Room, where will be located a circular saw and planers for student work (4), and a Wood Distillation Laboratory (3).

Embracing as it does such a broad field, the Division of Forestry possesses a number of features of special interest. Among these, one of the most interesting is the Logging Room (104). Here are to be set up demonstrations of the

various systems of logging with complete models in miniature. Also there will be models, miniature in some cases, and natural size in others, of the various kinds of equipment, such as locomotives, saws, and other logging apparatus.

Situated in the Wood Technology Room (112) is the nucleus of a very fine collection of woods from different countries which is to be enlarged as time goes on. The display of lumber grades (4) when completed will be a unique feature, as will also be the exhibit of the widest boards possible to cut from the most important timber trees of the world. The exhibit in special display cabinets of the hundred most important timber species of the United States, including the seed, seedling, mature foliage, and fruit, the bark, and the lumber, is something unique to this Division (113). Another feature of considerable interest is the collection of reconnaisance work instruments (109), which is very complete. All of the office and laboratory furnishings of this Division were designed by members of the staff.

The offices of this Division (312-316) deserve special mention, for they represent a very ingenious combination of private research laboratory and office made practically a necessity by the nature of the work done by the Division. They also contain a small herbarium, a seed room, and a fireproof vault for storing breeding records.

Situated immediately under the offices, on the second floor, are the laboratories and classrooms occupied by Genetics. These consist of a large General Laboratory for Sophomore classes accommodating fifty-six students at one sitting, equipped with student incubators for work with live insects, individual lockers, and an excellent set of permanent charts (209), a commodious Preparation Room adjoining the laboratory (208), a well-equipped Undergraduate Laboratory (207), and a Graduate Research Laboratory equipped with incubators and other apparatus (205)

and provided with a Computing Room (206) for biometrical and statistical work.

The offices occupied by this Division (330-334) are situated at the south end of the top floor.

The classrooms and laboratories are divided between the basement and second floors. On the latter there is a large general Student Laboratory (210), a spacious Collection Room (211), where are to be exhibited specimens of various fruit packages, and which will also contain the herbarium, a Research Laboratory (212), and a Seminar or Round-table Room for students (213), where informal discussion groups can be held.

The entire northeast quarter of the basement floor is occupied by the Fruit Handling and Packing Laboratory (14) and the Cold Storage and Refrigeration Plant (5-13). The latter, while designed especially for the experimental study of cold storage problems by the Division of Pomology, is available to all the divisions. It consists of a Motor and Machinery Room (11, 12, 13), where are located the refrigerating machinery of the most modern kind, expansion coils and a dehumidifier, and six cold storage chambers, of which two are insulating corridors for general storage purposes (7, 9), and four are small chambers maintained at a constant temperature and humidity, at 20 degrees (6), 24 degrees (8), 26 degrees (5), and 32 degrees (10). With these splendid facilities, it is hoped that important fundamental investigations on the keeping of fruits in cold storage may be carried on.

Another feature of special interest is the Fruit Handling and Packing Laboratory, adjoining the Cold Storage Plant. Here are located representative forms of fruit handling apparatus, in the nature of a sizer, washing and brushing machine, sorting and grading table, box-making machine, box press, trucks, and others. Here also is located a sulphuring box and a fruit-drying oven.

An interesting exhibit possessed by this Division is the collection of plaster casts, wax models, and water color

paintings of the most important varieties of apples grown in this state, begun by the late Professor Stubenrauch. This was designed to show the variation under different climatic conditions, and constitutes a very valuable collection.

The offices of this Division (317-322) are located on the east side of the top floor and contain a special feature in the shape of a draughting room and blue-print room.

The laboratories and classrooms are situated on the basement floor, occupying the southwest quarter. They comprise two large Sophomore laboratories, accommodations for approximately 100 students each (31, 33), a laboratory for advanced students (26), a Balance Room (27), a Centrifuge Room (25), where are located two centrifuges, one for soil analysis, and one for moisture equivalent determinations, two Storage and supply Rooms (30, 32), an Office (28), and an individual Research Laboratory (24).

This division has a collection of soil types from all localities in this state which have been mapped in conjunction with the United States Bureau of Soils. A special feature of the equipment is the arrangement of the laboratories. Each desk is a complete unit with balances, ovens, sinks, cabinets, and everything in the way of apparatus needed in the study of the principles of soil management.

The offices of this Division (335–337) adjoin those of the Division of Citriculture and open on the South Garden Court. The laboratories and classrooms are located on the second floor and comprise a Food Preservation Laboratory (202), fully equipped with canning and preserving machinery, such as vacuum condensers, presses, and other apparatus necessary for the investigation of the preservation of fruits, vegetables, and other foods, a Microbiological Research Laboratory (203), and a general Zymology Laboratory (204).

Nothing has been spared in the way of equipment to make these laboratories as complete as possible. A special feature is the Food Preservation Laboratory, which is designed for testing on a semi-industrial scale the results obtained in the Research Laboratory. The Zymology Laboratory is especially well equipped for research in enology, and food preservation, containing a scientifically constructed aseptic inoculating room for microbiological work, large built-in incubators for culture work with microorganism, specially fitted hoods with forced draught, and other features. The field of food preservation is an especially important one at the present time and presents many problems for research. This Division is engaged in establishing the principles underlying food preservation and their economic application.



A PANEL FROM THE MAIN FAÇADE



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JOHN MUIR, President 1892 to 1914

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Two Births 2000 Years Ago

A Story of the Oldest Living Thing In the World

PROPERTY OF DIVISION

Copyrighted 1917, by California Redwood Association

FORESTR

COLLEGE OF A AGRICULTURE

May 1, 1917



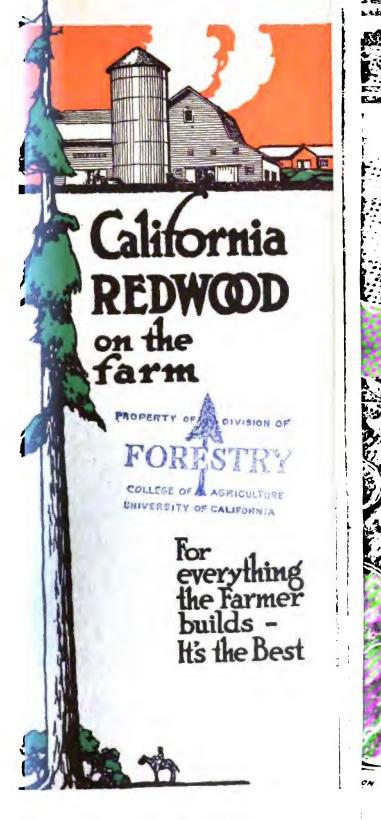
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This little booklet is dedicated to the children of the nation so they may become more intimately acquainted with the "Big Trees" of California, and their splendid service to mankind. Truly, there is something awe-inspiring in these wonderful forests of enormous trees. To stand beneath them is to feel strangely conscious of the majesty and power of age and strength—to touch the shaggy bark is to be thrilled with a feeling that you are reaching back thousands and thousands of years. Forests are majestic, but there is no majesty like that of the giant Redwoods.

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but it stood proudly defiant.

And, in the summer, when there was no rain, fire would sweep the undergrowth of the forest and attack the thick shaggy bark. But the tree stood like the Rock of Ages. It feared neither storm, fire or decay. Like the Spirit of Christ, it lived on.

This tree grew in California, in North America and in a land that those Wise Men did not know existed.

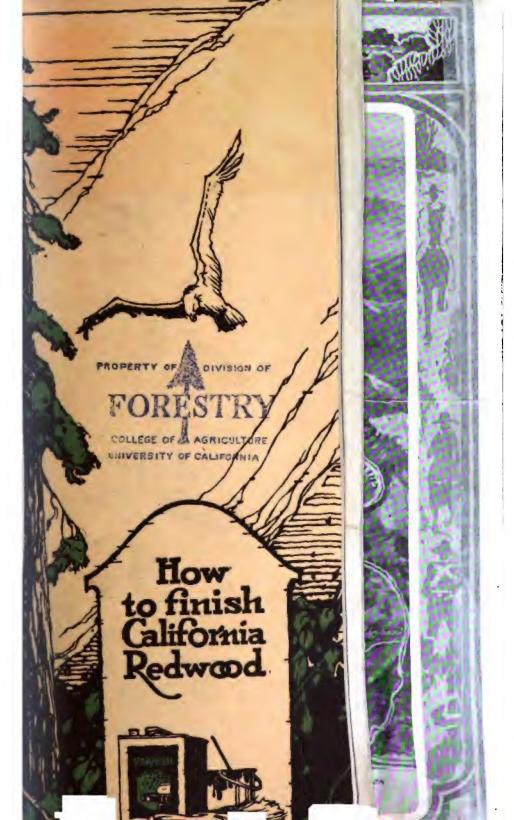
It was born on a low hillside facing the Pacific Ocean, and in a forest where there were millions of other trees like it. Great bears roamed this forest, and wonderfully beautiful ferns carpeted the floor. But, unlike other forests, there were no snakes or destructive insects among these trees. God intended that the Redwood trees should live, and so He protected them from decay, insects, fire and death.

As these trees grew bigger they pushed their way upward towards the sunlight—for trees, like children, love the sunlight. It is necessary for their healthy existence. They also grew close to one another in a spirit of brotherly and sisterly love that prevented the growth of other kinds of trees among them. Thus they grew as one great family.

One day a strange thing appeared on the ocean. I



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shape and is light and strong. Because of the great size of the Redwood logs they make beautiful wide boards without knots which are easily handled by the carpenter or cabinet maker.

The natural color of the Redwood is a soft, warm, light reddish-brown, and the painter can sandpaper Redwood to a surface as smooth as glass to be stained, or for painting. So it became the best building wood in California.

The fame of this tree grew and people in all parts of the world began to hear about the "Big Trees" of California. School teachers told the children wonderful stories of the "Big Trees." Their great size made people wonder how old they are.. Scientists know the age of a tree can be told by counting the rings that grow in circles around the center of the tree. So they visited these wonderful Redwoods and counted the rings of hundreds of trees. Professor Ellsworth Huntington, of Yale University, who made such a count, says that—

"A tree that has lived 500 years is still in its early youth; one that has rounded out 1,000 summers and winters is only in full maturity; and old age does not come for 17 or 18 centuries. How old the oldest trees may be is not yet certain but I have counted the rings of 79 that were over 2,000 years of age, of 3 that were over 3,000, and of one that was 3,150. In the days of the Trojan War and of the Exodus of the Hebrews from Egypt this oldest tree was a sturdy sapling."

Editorial Board, "Sicrra Club Bulletin": William F. (Editor), William E. Colby, Marion Randall, sons, Walter L. Huber, Albert H. Allen, Fra P. Farquhar, William T. Goldsborough, Joseph Le Conte, Elliott McAllister.



Scientists also discovered that these giant trees carry within their living bodies a story of the weather from the time the tree was born. By studying these rings the scientists can tell how much rain fell. In years when ever there was plenty of rain the tree grew fast and the rings are wide apart. When there was little rain the tree grew very slowly and the rings are close together.

Great sawmills are now at work in the Redwood forests cutting the giant trees into lumber. Some of the logs must be split with gunpowder before they can be sawn. Many logs weigh as much as a railroad locomotive!

There are so many of these great trees standing in the Redwood forests that it will take all the sawmills now sawing Redwood logs into lumber more than 100 years to cut up the trees.

The Redwood stump does not die. It lives to raise a family of baby trees, that grow from the stump as "shoots" or "suckers". These baby trees, like their parents, will some day be giants of the forest. The giant tree of today grew this way. They stand in circles, in family groups showing plainly they were mothered in the same

The Redwood stump is not selfish. It will mother other young trees as well as baby Redwoods. The picture on this page shows a Redwood stump at Scotia, California, raising a maple tree that is now 32 inches in diameter and 34 feet high. The maple is

way thousands of years ago.





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happy and satisfied with its strange mother for it is a very healthy tree.

After the giant trees are chopped down the woodsman cuts off the branches, "peels" off the bark and saws the long trunk into logs ready to be sent to the sawmill. But the logs are so heavy they cannot be handled until the branches, bark and other rubbish is removed. So the woodsman waits until the rubbish is dry and sets it on fire. The Redwood logs lie in this terribly hot fire 10 to 12 hours—but they do not burn!

The Redwoods are the oldest living things in the world. Even after falling down in the forest they refuse to die like other trees! Exposed to moisture or the damp ground Redwood lasts many times longer than iron or steel! Wonderful stories are told by woodsmen of the great living power of these giant Redwood trees. A 1000 years ago a big tree was blown down in the woods. A baby tree sprouted and grew from the fallen giant until it became a giant itselt. A woodsman chopped down the standing tree, which he found to be 1000 years old when he counted the rings. And there, on the floor of the forest, almost buried out of sight in the ground and under the standing tree, was the great Redwood that had

fallen down before the other tree began to grow!

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A PROCLAMATION.

The California State Board of Forestry, having in mind the great losses which the state of California annually suffers through the ravages of fire, desires to impress upon the people of the state the great necessity of care in the use of fire during the coming summer. Particularly at this time, when the economic losses brought about by the war are the greatest the world has ever known, should we all do everything in our power to lessen the annual loss which fire causes. Particularly should all the people of California remember how important it is to the prosperity of our state that vegetation upon our watersheds be protected in order that our subterranean reservoirs may be kept full. To campers, to those who are making clearings, and to tourists who travel through the mountain regions especially should the warning apply.

Now, therefore, in order to emphasize the need of fire protection and the importance of the campaign which the State Board of Forestry is carrying on, I do hereby declare the eighteenth day of April, 1918, as FIRE PREVENTION DAY, and trust that on that day all persons will make an effort to place their premises in such condition that the risk of fire will be eliminated so far as possible.

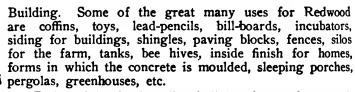
WILLIAM D. STEPHENS,

Governor.

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Redwood is the best for building homes because it resists rot, is hard to set on fire, and is a very beautiful wood on the inside for panels on the walls or ceiling, for base-boards, doors, moulding and other wood work. It is often used in natural color, without paint or stain, but many homes have each room finished in a different color by using stains on the Redwood. Redwood is a lumber from which is built the beautiful California bungalows.

This is the story of the "Big Trees" of California—the "Sequoia-sempervirens" as the scientist calls them; but just "Redwoods" as the people of California know and love them, and as the lumber from the "Big Trees" is known in the markets of the world.

Bottorial Board, "Sierra Club Bulletin": William F. (Editor), William E. Colby, Marion Randall: Sons. Walter L. Huber, Albert H. Allen. Fra P. Farquhar, William T. Goldsborough, Joseph Le Conte, Elliott McAllister.







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To OUR DEAR FRIENDS, THE CHILDREN OF THE NATION:

Tell your parents you want to live in a "Home of REDWOOD"—that you would love to live under the sheker and protection of those wonderful and beautiful "Big Trees" of California.

Tell them that REDWOOD does not shrink, warp or swell when properly seasoned, and that it is the best wood they can use to build the new home.

California REDWOOD can be had in your locality—if the retail lumber dealers do not carry it they can get it for you. It is not an expensive wood.

Have your parents write to us for a sample of REDWOOD, or anything else they want to know about REDWOOD.

CALIFORNIA REDWOOD ASSOCIATION, 711 New Call Building, (Dept. x) San Francisco, Calif.

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Fig. 2. This grainfield was not protected, and there was no system of fighting the fire after it started. The ripe grain was destroyed as well as the fences, which must be replaced at considerable expense.

When the wind is blowing and the fire is traveling so rapidly that a trail will not hold it, "back-fires," as they are called, are set along the trail while the main fire is still some distance away. The back-fire meets the main fire and, since there is nothing more to burn on either side, the fire goes out for want of fuel. Back-firing is most common in brush and timber fires, since they are usually the most difficult to control because of the large amount of fuel on which they feed.



Fig. 3. The grass by the roadside becomes dry as tinder, and the least spark of fire will set it affame.

1

Cauyus

Brush and timber fires.

As you ascend the road from the Sierra foothills you will see clumps of young pine and fir trees forty or fifty feet high. Beneath these trees is a carpet of needles which they have shed. Perhaps some rancher has been cutting cordwood, posts or poles and there are tops and limbs scattered about. (Fig. 5.) They are green now, and a fire would not burn very fiercely, but when you return several months from now the needles will be brown and dry. A fire will now spread rapidly, and soon kill all the young trees that are left.



Fig. 4. This fire started in the dry grass in the valley below and rapidly swept into a brush and timber area in the nearby mountains. It was fought by hundreds of men, but by the time it was put out it had destroyed much range, timber, property and, worst of all, several human lives.

Notice in figure 6 that the carpet of needles has been destroyed and the bare soil exposed. This layer of vegetable matter is very important to the welfare of the forest. It gradually rots, forming what is called "humus." This holds water which would rapidly run off from bare soil, and furnishes some of the important plant foods which are taken up by the fine rootlets of the trees. Its removal also causes the soil to wash away, especially on steep slopes. When large areas of mountain slopes are laid bare by fire, the "erosion," which is caused by heavy rains, fills streams with soil, rocks and gravel to such an extent that fertile fields in the valleys below are covered with this material and rendered unfit for agriculture.



ON THE COAST-TO-VALLEY HIGHWAY THROUGH TRINITY COUNTY FOREST

Vhat can you do to prevent fires?

28

"catface" in the butt so that the value of the first log for lumber is decreased; the tree is weakened and subject to windthrow, and access is afforded to insects and fungi which may kill the tree. (Fig. 8.) In the redwoods the hole that is burned out is called a "goosepen." Figure 9 shows what repeated fires have done to the base of a big tree, which is a species of redwood that grows in some parts of the Sierras.

There are times in the mountains when very destructive "crown fires" occur. Everything may be very dry, and if a fire starts when a strong wind is blowing it may be swept into the crown of large trees. Such fires are very difficult to stop, and often cause the death of many human beings. Fires of this kind did an immense amount of damage in the West a few years ago. Overton W. Price, in his book "The Land We Live In," tells the story of Ranger Pulaski, a descendant of Count Pulaski, a Polish nobleman who gave this country his services in the Revolutionary War.

"On the Cœur d'Alene National Forest, in northern Idaho, Ranger Pulaski had under him forty men, who after many hours of hard work had gotten a big fire practically under control. Suddenly the wind strengthened until it blew a gale. It immediately became a question of saving the lives of the men. The fire fighters were in deep forest, many miles from a railroad, and far from any clearing.

"Pulaski remembered that within a mile of where they were working there was an abandoned mine shaft, running back about forty feet into the hillside. He rushed his men to the shaft as quickly as possible, and told them as they passed through their camp to catch up their blankets as they ran. The shaft reached, Pulaski hurried his men into it, and, packed like sardines, they filled it full. Pulaski placed himself at the opening, across which he stretched a blanket.

"Within a few minutes after the men were in the shaft the fire came. The blanket at the opening caught and Pulaski jerked it away and hung up another, which caught in its turn. The blanket caught again and again, and each time Pulaski replaced it, until at last he held the blanket across the opening with his bare hands. The shaft grew hotter and hotter, and the smoke and fumes grew thicker and thicker, until the men's sufferings were almost beyond human endurance. They began to break for the opening. Pulaski, whose strength was great, like his courage, for a while forced them back. Seeing that he would soon be overpowered, and that his men would rush to their certain death, he drew his revolver, and said that he would kill the first man who broke away.

"In perhaps twenty minutes the worst of the fire passed by. Five of the men in the shaft were dead from suffocation; the other thirty-five were alive. Pulaski was blinded and seriously burned about the face



Fig. 7. Sugar pine is the largest pine in the world and furnishes wood that is very valuable for doors, sashes and finishing purposes.



Fig. 8. "Catfaces" are caused by repeated ground fires at the bases of pine trees. They damage the value of the butt logs for lumber, afford ready access to insects and fungi, and weaken the trees so that they are liable to windthrow.

ANNUAL BAINFALL AT WEAVERVILLE, COUNTY-SEAT OF TRINITY COUNTY

From July 1, 1871, to July 1, 1912

Year.	Inches.	Year.	Inches.
1871-1872	. 56.97	1892-1893	. 46.16
1872-1873	25.06	1893-1894	. 48.03
1873-1874	. 49.71	1894-1895	. 47.00
1874-1875	. 24.72	1895-1896	. 47.45
1875-1876	. 62.13	1896–1897	. 40.76
1876–1877	. 33.00	1897-1898	. 24.56
1877-1878	. 63.95	1898–1899	. 29.22
1878–1879	. 41.71	1899–1900	. 42.49
1879-1880	50.56	1900–1901	. 44.78
1880-1881	. 52.22	1901–1902	. 47.74
1881-1882	. 36.43	1902–1903	. 45.23
1882-1883	33.57	1903-1904	. 64.31
1883-1884	38.09	1904-1905	. 41.31
1884-1885	29.41	1905–1906	. 42.37
1885–1886	. 44.96	1906–1907	. 44.86
1886-1887	31.35	1907-1908	. 33.86
1887-1888	37.54	1908–1909	. 44.36
1888-1889	29.75	1909–1910	. 35.€3
1889-1890	. 67.04	1910–1911	. 29.86
1890-1891	30.18	1911–1912	. 30.80
1891-1892	36.56		

TABLE OF ALTITUDES IN TRINITY COUNTY

Feet	Ł.
Thompson Peak, at head of Stuarts Fork	5
Mount Bally, near Weaverville	5
Bullychoop Mountain 707	0
Trinity Mountain on Lewiston Turnpike	5
Trinity Mountain on Buckhorn Road 325	0
Chanchellula Mountain	0
Goods Mountain on Red Bluff-Hay Fork Road 360	0
North Yola Bola Mountain 800	0
Grizzly Mountain in southwestern Trinity	0
Trinity Center and Trinity Valley	0
Minersville	0
Lewiston	0
Weaverville	0
Douglas City	0
Junction City	0
North Fork	0
Big Bar	0
Hawkins Bar 77	2
McDonalds (Burnt Ranch)	0
Mouth of South Fork	0
Hyampom Valley 120	0
Hayfork 227	5
Mad River 260	0
Eel River 40	0
Zenia 280)()

THE NEED OF PROTECTING OUR FORESTS.

The forest, brush and grass areas in California, outside the national forests, are not well protected, since the state legislature has not authorized a cent for fire fighting or the establishment of a protective system such as is in the national forests. The State Forester appoints firewardens, but they receive no pay and can not be expected to give fire the attention that is given by the forest officers employed by the Federal Forest Service. California needs good forest laws, especially those which will protect her resources against forest fire. We will not have these laws until its citizens realize how greatly fires injure them.

Carelessness causes most of our wasteful fires. People leave camp fires burning, throw burning tobacco into dry grass, burn brush when it is dry and the wind is blowing, without stopping to think of the danger from fire and the injury it will do them if it spreads. If our forests were destroyed, every one of us would suffer, since many of our industries, which are dependent upon the timber and water which they furnish, would have to shut down, and many people would be thrown out of employment.

The future prosperity of California largely depends on how the boys and girls are going to treat the forests. If they waste them by carelessly burning them up, there will be hard times for everyone. If they protect them, they will furnish plenty of wood for our many needs, keep the flow of our streams even, prevent floods in the wet season, furnish water for irrigation and power during the dry season, pay taxes to support our government, roads and schools, shelter our wild game and fish, and in many other ways make our country healthier and pleasanter to live in.

QUESTIONS ON LESSON.

- 1. What is the purpose of Fire Prevention Day?
- 2. What would you do if you saw a small grass fire burning?
- 3. What would you do if you could not put out the fire?
- 4. How are grain fires fought?
- 5. What is a "fire trail?"
- 6. What is the effect of the destruction of "humus"?
- 7. What are "catfaces" and goosepens"?
- 8. Tell the story of Ranger Pulaski.
- 9. Why is a "crown fire" hard to put out?
- 10. What can you do to prevent fires?

TRINITY COUNTY CALIFORNIA



A PARADISE FOR THE SPORTSHAN AND VACATIONIST

BACKAMENTO, CALIFORNIA

OCTOBER, 1917

COUNTY



WASHING MINERAL WEALTH FROM THE HILL

10. What can you do to prevent fires?

MONTHLY BULLETIN



Florids grapefruit tree affected with citeus canker. Imspectors are destroying the

OF THE

STATE COMMISSION OF HORTICULTURE

SACILAMENTO, CALIFORNIA

OCTOBER, 1917

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THE MONTHLY BULLETIN.

CALIFORNIA STATE COMMISSION OF HORTICULTURE

October, 1917.

No. 10

CITRUS CULTURE IN JAPAN, CHINA AND FORMOSA.

By CURTIS P. CLAUSEN.

During the writer's recent trip to the Orient in search of beneficial insects opportunity was presented from time to time to investigate and observe various matters relating to citrus culture in Japan, China and Formosa. Naturally, the methods employed were markedly different from those employed in California, due to various economic factors which will be discussed later. Inasmuch as citrus trees have been grown in the Orient for commercial purposes for many centuries, the practices of the growers have become in a large measure standardized, and it is only in Japan that the results of detailed scientific research have come to be generally utilized. In this article the various methods employed in the different countries will be discussed in due order.

JAPAN.

In Japan, according to Prof. T. Tanakawa of the Okitsu Agricultural Experiment Station, citrus fruits have been grown for about three hundred years and at the present time they are one of the most important fruit products of that country. The producing area extends roughly over a range of about nine hundred miles from Tokyo southwards to Nagasaki. The most extensive plantings are found in Schidzuoka and Wakayama prefectures and the finest quality of fruit is grown in these sections. The official 1915 census gives a total citrus area of approximately seventy-five thousand acres of bearing trees. The annual increase in acreage is very slight as the new plantings are usually about equal to the area from which citrus trees have been removed.

The conditions under which citrus trees are grown in Japan are quite different from those existing in California. The level, fertile lands are used almost exclusively for rice and barley, being considered too valuable to devote to citrus trees. It is for this reason that nearly all citrus is grown upon the hill-sides, often being upon steep terraces. In many cases it is necessary to build a stone retaining wall ten or fifteen feet high in order to enclose sufficient soil for a small row of trees. These terraces are irregular in form and are built to conform as closely as possible to the contour of the hillside. This method of planting renders the various operations of cultivating, harvesting, pest control, etc., much more difficult. This disadvantage is in a large part offset by the cheapness of labor, and all work is done by hand.

Climate.

The climate of the citrus belt is, on an average, somewhat colder than that of southern California. Even Nagasaki, at the southern end of Kyushiu, experiences frequent falls of snow during the months from January to March. Since the fruit is harvested during the fall and early winter, injury is very seldom done, though occasionally an extensive leaf drop occurs and the twigs and smaller branches may be injured. This was the case during the past season, which was the coldest experienced in many years. Under normal conditions orange trees in Japan are able to withstand a lower temperature during the winter than in California, this being due largely to the high humidity and the relatively low temperature which usually prevails during the daytime.

Vol. VI.

Varieties.

By far the most important of all the varieties of citrus grown in Japan is the Oonshu, or Satsuma orange, the area devoted to this variety, according to the government census, being approximately 52,300 acres. The fruit produced, amounting to approximately 165,000 tons per year, represents in value practically nine-tenths of the entire citrus product of the empire. Under normal conditions the price secured by the grower is from three-fourths of a cent to one cent per pound, sales always being made on the basis of weight.



Fig. 124. Citrus orchards in Japan showing the terraced arrangement on the hillsides. (Original.)

The fruit is of medium size, very deeply colored and practically seedless. The skin is comparatively thin and very loose, having a strong tendency towards puffing. Because of this loose skin the shipping qualities are rather poor as compared with the California varieties. The fruit is very juicy and its flavor excellent, it being somewhat sweeter than the Navel orange.

The Navel orange is a comparatively recent importation into Japan, the first trees being started about 1900, and consequently only a few have as yet reached their full bearing capacity. According to the 1915 census, there were about 5,000 acres planted to this fruit. Indications are, however, that this will in time come to be one of the leading varieties in Japan, especially for export.

The Natsumikan, or Japanese pomelo, is quite extensively grown, there being approximately 12,000 acres. This is a fruit somewhat similar in appearance to the California pomelo, though somewhat smaller and slightly flattened at the ends. The flavor, however, is quite distinctive and is considered by many people as superior to that of the California product. One point very much in its favor in Japan is the comparative freedom from injury by citrus canker.

Local Consumption.

The consumption of citrus fruits by the Japanese people has not been great in the past because of their being considered largely as luxuries and also because of a general dislike of any sweet fruit, a crisp fruit with a rather tart flavor being much preferred. This is shown in the case of the Japanese pear, which is very crisp and juicy and, to a foreigner, almost entirely devoid of

or. Local consumption of oranges, however, is increasing quite rapidly and undoubtedly result in more extensive production in years to come.

Exports.

In past years large quantities of citrus fruits have been exported to America, Canada, Manchuria and Russia. The quarantine regulations promulgated in recent years by the American authorities against citrus stocks and fruit from the Orient because of the citrus canker have shut off this field of export completely. Naturally this has given rise to numerous protests from the growers of Japan, who, as a rule, do not appreciate the great risk to the California citrus industry from the introduction of this disease.

Cultural Methods.

Because of the irregular terraced hillsides upon which citrus is usually grown, and also because of the relative cheapness of labor, practically all cultural operations are performed by hand. The trees ordinarily are considerably



Fig. 125. Pest control in the citrus orchards of Japan. Owing to the steepness and the peculiar arrangement of the terraces power sprayers are not used. The photograph shows a bucket pump in operation. (Original.)

smaller than Navel and Valencia trees of California and are, therefore, planted more closely together. Usually there are about one hundred and fifty trees per acre, but with some varieties the number may be increased to over two hundred. Clean culture is usually practiced, though in Schidzuoka and Wakayama prefectures tea is often grown between the rows. Judging from the appearances of the trees grown in this way, interplanting with tea is not a desirable practice, as the trees were invariably in poor physical condition and produced only a light crop of fruit. Vegetables of various sorts are frequently grown between the trees, and without any noticeable detrimental effects.

Pest Control.

A great variety of pests are found attacking citrus in Japan, and the problems arising in their control are oftentimes very difficult. Much injury is done to the trees by the citrus canker, the white fly, and various other insect enemies. The canker is often combatted by the use of a Bordeaux spray, applied with a knapsack pump, though with doubtful results. This is the only method of application practicable because of the position in which the trees are grown. Scale control is usually accomplished by fumigation, but this is proving to be a very expensive proposition, as the potassium cyanide, which is still used, costs approximately seventy-five cents per pound. In general fumigation the work is done entirely during the daytime, and oiled paper tents are used instead of canvas. These paper tents are considerably cheaper in initial cost than those made of canvas, but are not nearly so durable and require extensive patching, so that for continuous work the cost of the two types is about equal.

CHINA.

The writer's observations upon citrus culture in China cover only the sections from Foochow southwards to Canton, though citrus is grown quite extensively in several provinces further north. It was not possible to secure any accurate data bearing upon the acreage or production in these provinces because such information is not collected by the government or by any other agency. The methods employed in growing this fruit are practically identical with those used several hundred years ago, as no scientific study of the various problems confronting the industry has as yet been undertaken.

Climate.

The climate of the citrus producing sections of China is in general somewhat colder during the winter than that of southern California and covers a longer period of time. More or less injury to the trees occasionally results from unusually cold weather, but is no more frequent than in this state. The summers are extremely hot and the humidity high during the entire season.

Varieties.

There are three varieties of oranges grown generally throughout China, these being the Ponkwan, or Mandarin, the Suikwan, and the Tankwan. The first-named variety is by far the most extensively grown and is an excellent fruit for local consumption. It is very loose skinned, sweet, and in general somewhat similar to the Satsuma orange of Japan. The Suikwan is not as sweet as the Ponkwan, but has a much tighter skin, which gives it better shipping qualities. The third variety, the Tankwan, is probably a hybrid of the two first-named varieties. It is rather small and with a medium thick skin, and has much the flavor of the tangerine, which it somewhat resembles.

Two varieties of pomelo are grown in the south China section, particularly in the vicinity of Amoy and Swatow. The Matabuntan, or white pomelo, is the best and is more extensively grown than the Toyu, or red variety. The fruits in both cases have a very heavy skin, often one-half inch in thickness, and are very large. A number of fruits in the local market were weighed, and averaged nearly six pounds. The flavor is excellent and quite distinct from that of the California or Japanese varieties. In serving, the skin is first removed and then the tough membrane surrounding each section is taken off, after which portions of the section may be easily removed without breaking the cells.

A considerable proportion of the fruit produced is sold in the local market, the value ordinarily being from 6 to 8 cents each. The fruits are divided and sold in sections rather than as a whole. Large quantities are also exported to various ports on the China coast, usually being transported in bulk by sailing vessels. Often it is necessary to carry the fruit long distances overland, and this is done by native carriers, or coolies, each of whom carries two large baskets on the ends of a pole slung over the shoulder. A single coolie will often carry a load of 200 pounds in this way 20 or 30 miles per day.

Cultural Methods.

The cultural methods employed in China depend largely upon the section in which the trees are grown. In the Foochow district oranges are produced almost exclusively upon the level areas among, or adjacent to, the rice paddies. Inasmuch as these are constantly flooded it is necessary to adopt some means of drawing off the surplus water from the surface soil. As a grove usually comprises only about seventy-five to one hundred trees, this is accomplished by making a large excavation in the center of the grove, this usually measuring nearly one hundred feet in width and about ten feet in depth. The water which accumulates in this reservoir is pumped out from time to time into the

adjoining rice paddies. In addition to the above means of eliminating surplus water, the trees when first set out are planted upon mounds about two feet in height. As the trees become older these mounds are increased in size, so that when mature the trees are upon mounds five or six feet high. It can not be said, however, that this practice is satisfactory, as the groves observed were invariably in very poor physical condition and of low producing power. Naturally the quality of the fruit was very poor.



Fig. 126. Orange trees in the Foochow district of China. Note the drainage basin in the foreground. The trees are planted on mounds averaging about two feet in height, but as they grow older the size of the mound is increased. Those shown in the photograph are about six feet in height. (Original.)

The pomelo is largely grown in the river sections above Amoy and Swatow, and the methods of culture employed are quite different from those used in the orange-producing sections farther north. The level lands adjacent to the rivers are devoted almost exclusively to the production of this and other fruits. In these groves clean culture is invariably practiced. The trees were found to be large, heavy bearing and in excellent physical condition, and many of these groves would compare favorably with any found in California.

Pest Control.

The insect pests of citrus are not nearly so numerous or destructive as in Japan and it is very seldom that an infestation becomes bad enough to cause serious injury. One exception to this, however, is a large Cerambycid borer, which does very extensive injury in all sections. The larvæ bore into the trunk and larger branches and often girdle the tree, eventually killing it. Control, when undertaken, is by cutting out the larvæ with a knife or chisel.

FORMOSA.

Citrus culture has not as yet come to be of any commercial importance in Formosa, and the fruit produced is of an inferior quality. The varieties are the same as are grown in China and the original stock was undoubtedly brought over when the island was under the control of that country. No large plantings were observed in any part of the island, most of the trees being in small groups about the houses, etc. One of the best plantings was found at Musha, a small savage village in the center of the island at an elevation of about forty-five hundred feet. The trees were heavily loaded with fruit of rather small size, but none of these were ripe at the time of the writer's visit and the flavor and quality could therefore not be determined.

The agricultural experiment station at Taihoku is engaged in a study of the various citrus varieties in the hope of securing some which will be adaptable to the climatic conditions of the island. An effort was made to establish the lemon in that section, but the trees failed to grow and produce fruit satisfactorily.

THE SELECTION OF PETROLEUM INSECTICIDES.

By ROBERT K. VICKERY. Superintendent Rex Spray Company. Benicia. Cal.

There are a number of useful tests that may be applied to insecticides prepared from petroleum in its various forms. These may be divided into three classes:

- (1) Tests to determine the killing power of the oil with reference to the insect for which it is intended.
- (2) Tests to determine what injury the oil may do to plants with which it may come in contact. This will not be considered in this paper as Prof. George P. Gray and Prof. E. Ralph De Ong of the California Experiment Station are expecting to publish on this subject.

(3) Tests to determine the efficiency of various methods of applying the oil to the pest, emulsions, etc.

There is much that can be learned by a study of how petroleum kills an insect. The work of Prof. George D. Shafer, published in technical bulletins, Nos. 11 and 21, of the Michigan Agricultural Experiment Station, has changed our conception of how the oil acts on the insect. It has been held for a number of years that death followed the plugging of the spiracles by the viscid oil. That death was not due to suffocation was demonstrated by Mr. Shafer in a series of intricate experiments in which the insects were immersed in pure gases such as hydrogen. He proved that it was some toxic quality in the oll that killed the insect rather than a mere mechanical suffocation due to the stopping of the spiracles.

Mr. Shafer next proved that it was the vapors of the lighter fractions of the oil that were the chief toxic agent. This is logical since the oil need not

come in contact with the insect in order to be effective.

From these premises he went on to determine what organ, or system of organs, was affected by the vapor of the petroleum. He found unmistakable evidence that the system of enzymes in the body fluid of the insect was very seriously upset and concluded that this disarrangement was probably the cause of death. He further drew the conclusion that it was the inhibition of the reducing enzymes that was the vital factor. The obvious conclusion was that with the reducing enzymes out of action that the insect was literally burnt up by the freeing of the oxidizing enzymes.

The writer repeated this part of Mr. Shafer's work and came to slightly different conclusions. Good material in the form of silkworm larvæ was used and the reactions were speeded up considerably by the use of liquid air. The conclusion was drawn that insects that had been exposed to the effects of petroleum vapor showed a marked increase in the oxidizing enzymes rather than a reduction of the reducing enzymes. In a histologic study it was found that the œnocytes, which are ductless glands located close to the spiracles and in contact with the tracheæ were very active when subjected to the gases given off by oils. According to Glazer (Biological Bulletin, Vol. XXIII, No. 4, Sept., 1912) these ductless glands are the source of an oxidizing enzyme. The fact that these cells are stimulated to produce more enzymes under the effect of petroleum lends weight to the above opinion. This opinion is not of much value, as under present methods, quantitative work with enzymes, such as those found in the invertebrates, is out of the question.

From the practical point of view, however, Mr. Shafer's work must be considered in the selection of insecticidal oils. It is evident that the oil must have a due proportion of volatile fractions. On the other hand it is just as important that the light fractions be accompanied by a heavy gravity oil in order to keep the volatile portions from evaporating too rapidly. The best killing oil in some cases may be a blend of a light fraction and a heavy lubricating oil, or it may be in other cases an average oil such as kerosene or stove distillate.

The so-called "penetration" of an oil spray depends on the capillarity of the oil. In the case of the armored scale insects, for instance, the oil with the best penetration would be the one that would creep the farthest under the scale covering. Therefore, it is essential that a spray oil should have those ingredients in it that will give it a high degree of capillarity. Capillarity can be measured in the laboratory by means of fine-bore tubes. Professor Gray has devised a method for rapidly testing the relative capillarity of oils. He uses crayon sticks—the common chalk used for writing on blackboards—and by noting the relative heights to which the oils climb and comparing with a water standard he gets a basis for a practical comparison.

So far factors have been considered that can be determined by a physical analysis of the oil. In order to get the right proportion of light and heavy oil it is necessary to resort to field experiments on the insect it is desired to kill. To be accurate these experiments must be on a large scale. In the case of orchard insects rows, plats or acres should be used to compare different samples and not just units of trees or branches. It has been found by experience that laboratory experiments are out of the question.

If all oils were identical in composition there would be nothing further to investigate. Unfortunately they are not and we have much more to learn about their toxicology. Petroleum is a complex mixture of many compounds and series of compounds. It has been found that the oils from different fields and even wells in the same field differ radically from each other. It is absolutely unknown which ingredient or ingredients of the oil contain the toxic qualities. It is no doubt true that in many cases where oil sprays have failed and meteorological conditions blamed that it was the lack of some essential ingredient in the oil that was the real cause of failure. Some day when the division of petroleum into its constituent compounds is practical on a large scale, it will be possible to find out which are the important killing agents. That knowledge will eliminate this factor of doubt.

In the meantime it is practical to find which groups of oils are most effective. Out of many possibilities the following short list will give examples of different oil types that can be compared. Some of these types will prove uniformly more effective than others, thus evading in a practical way our lack of knowledge of the real toxic elements in the oil.

- 1. Pennsylvania paraffin base crude oil.
- 2. California asphalt base crude oil.
- 3. California paraffin-asphalt base crude oil (Coalinga).
- 4. Pennsylvania kerosene.
- 5. California kerosene.
- 6. Crude oil with sulphur compounds.
- 7. Crude oil low in sulphur compounds.
- 8. Crude oil with nitrogen compounds.
- 9. Crude oil low in nitrogen compounds.
- 10. Crude oil with unsaturated compounds present.
- 11. Crude oil with the unsaturated compounds removed.
- 12. Stove distillate with cracked products present.
- 13. Stove distillate with cracked products removed.

This list could be indefinitely extended by including oils from different localities, other fractions of the oils, and also distinguishing between some of the unsaturated compounds. Field experiments are practical for a comparison of the effectiveness of these different types of oils.

Any experiments on the effect of oils on insects must also consider the effect of oils on the host plants on which these insects live. Plant physiologists tell us that petroleum is more or less injurious to plants. Ultimately it may be found that either the compounds in petroleum toxic to insects are the same as those injurious to plants, or it may be found that they are totally different. Whatever that ultimate discovery may be, at the present time it is necessary when spraying plants to dilute the oil with water by some method. The concentration of oil in water must be the minimum that will kill the insect in order that the injury to the plant may be as little as possible. This fact is one of the axioms of insect control.

This brings us to the subject of the application of the oil to the insect. The problem is simply mechanical where plants are not concerned such as the control of mosquito larvæ, household pests, etc. As stated above where plants are involved some method of dilution with water is necessary, and since oil and water are not mutually soluble, it is necessary to resort to the use of some form of emulsion. The simplest form of an emulsion is the mechanical mixture of water and oil. This involves the use of a machine so constructed

that oil and water can be agitated until a momentary emulsion is formed that can be applied to the plant before it breaks into oil and water again. Formerly this method was extensively used, but now its application is limited to the spraying of olives for black scale and for a few other uses.

Most emulsions used for spraying are more or less permanent in character. This permanence is brought about by the addition of a third substance to the oil and water. The simple emulsions in which the drops of oil are merely entangled in the minute particles of some finely divided insoluble substance have been called by Pickering quasi-emulsions. The limoid or calcium hydrate emulsion is a good example. There is a simple gradation through the use of various emulsifiers or third substances from the simple quasi-emulsion to the highly complex true emulsions.

It might be well at this place to define a true emulsion. In this country the study of emulsification has been led by Prof. Wilder D. Bancroft of Cornell University. From his several articles and summaries in the Journal of Physical Chemistry, the following brief statement has been devised. emulsion must have three components. There must be two nonmiscible or partially nonmiscible liquids such as oil and water. There must be a third component which is commonly called the emulsifier. One liquid occurs in the form of drops and is said to be in the dispersed phase. The other is the matrix liquid and is said to be in the dispersing or continuous phase. The function of the emulsifier is to form a layer or pellicle around the drops of the liquid in the dispersed phase to keep these drops from coalescing. How the emulsifier performs this function is still a matter of theoretical conjecture. The laws of surface tension account for the formation of the drops and for the pellicles that inclose the drops. The static electric charges on the drops are supposed to hinder coalescence by causing the drops to repel each other. The writer has found that there is heat absorbed in the formation of an emulsion which would indicate a molecular rearrangement. This molecular rearrangement is also shown in the fact that in a true emulsion where there is a maximum of oil emulsified in a minimum of water the viscocity of the resulting emulsion is always greater than that of its component liquids.

There are certain facts that limit the selection of a true emulsifier. emulsifier must be colloidally soluble in the dispersing liquid. If the emulsion is to be the common one of oil dispersed in water, then the emulsifier must be colloidally soluble in water. The petroleum insecticides belong to this group, as the oil is in the dispersed phase and the water is the continuous liquid. Soap, the usual emulsifier, is colloidally soluble in water. On the other hand it is perfectly feasible to get an emulsion of water in oil. All that is necessary is that the emulsifier shall be colloidally soluble in the oil. The oil companies are greatly troubled by an emulsion of water in oil that forms when they pump crude oil. In this case it is the colloidal substances dissolved in the crude oil, asphalt, etc., that acts as the emulsifier. There is a long list of substances that can act as emulsifiers of petroleum in water. Our choice of an emulsifier of oil for insecticidal purposes is by no means limited to soaps. Colloids as different as iron hydroxide, soluble silica, zinc sulphid, and gelatin gave excellent emulsions. In making a spray emulsion, the emulsifier is added to the water and then the oil added in gradually. If the emulsion is to be very much diluted the oil can be put in all at once. It is necessary to follow this general scheme in order that the emulsion shall have the oil as drops and not the reverse phase.

For spraying purposes an emulsion approaches perfection as the drops become smaller and more uniform in size. One advantage is that the emulsion is much more stable with small even drops. Also under these conditions the application of the oil is more uniform which increases the insecticidal power of the spray. The injury to the plant is decreased because no drops of free oil gather to cause burning.

It is often desirable to know what is the correct amount of a certain emulsifier to add to a given oil. Up to a certain limit the addition of more emulsifier has the advantage of decreasing the size of the drops. After this limit is reached no addition of emulsifier will cause the drops to get any smaller. The minimum size of the drops seems to be a function of the oil. If there is insufficient emulsifier the size of the drops vary and are generally larger than the minimum.

Some idea of the size of the drops can be gained with a compound microscope equipped with an oil immersion lens and an eye-piece micrometer. The emulsion should be under a cover glass on a slide. It is better to separate the cover glass from the slide by the thickness of a ring of quick-drying black asphaltum painted on the slide. It is much simpler to take a microphotograph of the emulsion and study the print. The Dark Field Illuminator improves the definition of the picture. A plate is always a little hazy owing to a slight vibration of the drops. This, however, does not interfere with the accurate calibration of the size of the drops.

The so-called "miscible oils" are a commercial preparation in which the emuisifier is held in the oil either by suspension or by colloidal solution. These miscible oils, when mixed with water make excellent emuisions. It is difficult to make a uniform product and the price at which the oil is sold makes it uneconomical for orchard use.

These principles for the selection of an oil spray were evolved during the course of certain experiments performed in behalf of the Bean Spray Pump Company under an industrial fellowship financed by them in the entomological department of Stanford University. The details of these experiments are the property of the company.

SOME FACTS ABOUT THE ERADICATION OF CITRUS CANKER.

By A. S. HOYT, Southern Field Deputy.

State Commissioner of Horticulture G. H. Hecke, in order to obtain at first hand a working knowledge of citrus canker and the methods employed in its eradication sent the writer recently to Florida to make a thorough field investigation. Thanks to the courtesy of the Florida State Plant Commissioner Wilmon Newell, the records containing the history of this remarkable campaign from its beginning up to the present time were freely offered for the purpose of making a study in detail. Many interesting facts were noted among which the seasonal variation in the activity of the development of citrus canker deserves mention. It is at once noted that the month of August stands as a high-water mark for the detection of infected trees.

To one who is only slightly familiar with Florida conditions this fact is readily explained as is also the accompanying fact concerning the development of the disease. The warm seasonal rains coming during the latter part of July and August with the consequent period of active vigorous growth bring about an ideal condition for the development of any organisms which may have been present, perhaps for a considerable length of time but which because of climatic or other reasons remained dormant. In August of 1914, 1,313 infected grove trees were found. In August, 1915, this number was slightly exceeded and at the same time the largest number of infected grove trees found in a single month was recorded with the discovery of 1,345 infected trees. Compare with these figures the 219 infected grove trees reported in August, 1916, or the 30 infected grove trees found in August, 1917, and we see a very encouraging and positive assurance that by the maintenance of the present standards of the work, and by the continued cooperation of the United States Department of Agriculture and the State Plant Board of Florida this disease, virulent and destructive though it be, may be completely wiped out.

The eradication of citrus canker is based fundamentally on four factors; first, rigid inspection, second, prompt destruction of infected trees, third, disinfection of persons and things exposed to infection, and fourth, adequate quarantine to prevent the movement of articles, especially nursery stock, likely to carry infection from an infected district into or through a territory which has not previously shown infection. The inspection consists of a careful tree to tree inspection; weekly in infected groves and in groves known to have been exposed to infection, bimonthly in groves in which no infection has been found and which are not known to have been exposed to infection but which by their proximity to infected groves are regarded with suspicion, and quarterly in groves which have not shown infection, are not known to have been exposed to infection and which are distant more than one mile from the nearest infection. The destruction of infected trees is accomplished as promptly as possible

after discovery and with every precaution to prevent the dissemination of the bacteria. Beginning with the disinfection of the surface of the ground about the infected tree, then burning with a kerosene torch completely defoliating the tree and blackening with the fiame the trunk and branches, grubbing out the tree and carefully working over the soil to obtain as nearly as possible all the roots and then the final



Fig. 127. Inspection of large orange seedlings for evidences of citrus canker. The photograph shows the method of inspecting very tall trees from 2s-foot ladders. The men use binocular field glasses. Great care is taken by the inspectors to avoid touching the trees at any time, (Original.)

spraying of the soil with formaldehyde at the same time thoroughly stirring the ground in order to permit the greatest possible penetration of the disinfectant, and all accomplished with the greatest precision, seems to have reduced to a minimum the danger of spreading the disease.

The disinfection requirements are very strict and are vigorously enforced. Laborers and any persons who find it absolutely necessary to enter infected groves comply fully with the sanitary precautions as required of the citrus canker inspectors, with the difference only, that the inspectors follow the same precautions on entering any property where citrus is grown regardless of whether infection is known to be present or not. A special hat, a one-piece inspection suit, canvas leggings and high shoes compose the inspectors' uniform and completely cover the regular clothing. This uniform is submerged in the disinfectant thoroughly, the hands, face, neck and head are carefully sponged with the disinfectant and this process is carried out unfailingly before and after entering each grove. In passing from grove to



Fig. 128.—Destruction of an infected grapefruit tree by fire, showing the kerosene torch and the bucket pump used for this work. (Original.)



Fig. 129.—The clothing and all parts of the body which are exposed during inspection work are carefully disinfected before and after entering any citrus property. This disinfection is performed regardless of whether the property is infected with citrus canker or not. (Original.)

grove during his recent investigations in Florida the writer was obliged to disinfect or

"dip" as many as eight times in one day.

Early in the campaign to eradicate citrus canker from the groves of Florida it was found that these three factors were not sufficient and it became necessary by means of quarantine to control the movement of articles likely to carry infection and which from their very nature were not readily susceptible to disinfection. It was found also that citrus canker bacteria might be present but remain dormant for many months. No amount of inspection could detect an infection of this kind. This danger was especially acute in the case of citrus nurseries where a dormant infection might not be discovered until the nursery stock had been moved, planted out in groves and then a new center of infection developed. To meet this situation the State Plant Board adopted a rule establishing quarantine zones about infected properties. These zones contain all that territory within a mile in any direction from the outside boundaries of a grove in which infection is found. The movement of citrus nursery stock from nurseries situated within such a mile zone is prohibited to points outside such zones. On the preservation of this quarantined area about infected groves, on the strict enforcement of the necessary sanitary precautions, on the continued and careful inspection to find and destroy as quickly as possible the infected trees depends the success of the campaign to eradicate citrus canker.

THE PEAR WOOLLY APHIS.

By W. M. DAVIDSON,† United States Bureau of Entomology, Deciduous Fruit Insect Investigations, Sacramento, Cal.

Introduction.

Owing to great similarity in general appearance the woolly aphis of the pear (Eriosoma pyricola, Baker & Davidson)* (1) has until recently been confused with the woolly aphis of the apple (Eriosoma lanigera, Hausmann). To the naked eye the two insects are hardly distinguishable, but the assistance of a magnifying lens shows that the wax threads on the pear species are stiffer and stouter than those on the apple insect, while the body color of the former is, except in newly-molted individuals, considerably paler than that of the latter. The pear species is also much more elongate in form.

Unlike the woolly aphis of the apple which occurs both above and below ground the pear woolly aphis infests only the subterranean portion of the pear tree, the woolly aphis sometimes encountered on limbs of certain varieties of pears,

e. g., Winter Nelis and Easter Beurre, being Eriosoma lanigera.

The project embracing the investigation of the pear woolly aphis was undertaken at the instance of Dr. A. L. Quaintance, Bureau of Entomology, in charge of deciduous fruit insect investigations. The studies were made principally at Walnut Creek, California, during the years 1915 and 1916. The writer wishes to express his thanks to Mr. R. L. Nougaret, Bureau of Entomology, for helpful suggestions, to Mr. V. G. Stevens for his services in field and laboratory while employed in the Bureau of Entomology, to Mr. George P. Weldon, California State Commission of Horticulture, to Mr. F. C. Reimer, superintendent Southern Oregon State Experiment Station, and to the county horticultural commissioners within whose territories the woolly aphis exists, for helpful cooperation.

Distribution.

The insect has without doubt existed in California for over twenty years and is now established throughout the pear-growing sections of northern and central California. According to reports received from county horticultural commissioners, it does not occur south of Tehachapi Pass nor in the region of the southern end of the San Joaquin Valley. In these districts the acreage in pears is relatively small. In the Santa Clara and San Ramon valleys, throughout the foothill regions of the Sacramento Valley and in the "delta" section the aphis is abundant. In southern Oregon the insect is widespread and the damage is similar to that caused in California. The insect has been taken in Ohio on pears the year after they were imported from Europe, while galls on the alternate host, the elm, have occurred in

[†]Published by the permission of the Secretary of Agriculture.
*Figures in parentheses refer to "Literature Cited" at the conclusion of the article.

Maine (2). Our species is quite probably identical with the European pear woolly aphis (*Eriosoma lanuginosa*, Hartig), but not sufficient European material has been obtainable to make this point a certainty.

Injurious Aspects.

The injury occasioned by the root aphids consists in stunting and, infrequently, outright destruction of young trees naturally weak. Naturally vigorous trees rarely suffer beyond the extent of an early yellowing and dropping of the leaves. Older trees sometimes show a stunting in the branches and early defoliation, but the amount of injury suffered by trees with a well-established root system is obscured by reason of the weak indications. Long and persistent study might show some effect on the quality of fruit, but our present knowledge on such possible effects of aphis work does not lead beyond theorizing.

Woolly aphis injury is closely connected with soil conditions, the greatest amount of damage occurring on heavy soils which become hard and dry after midsummer. Trees on such soil presumably lack adequate moisture in the early fall when the aphis is most abundant and they succumb to the combination of drought and aphis, although normally the pear is capable of standing considerable dryness and uninfested trees under normal orchard conditions pass through this period of drought. On the lighter soils of sandy and gravelly types sufficient moisture is conserved to enable infested trees to pull through. A like result obtains in irrigated orchards, but the irrigation itself checks the aphis but little, rather serving to invigorate the tree.

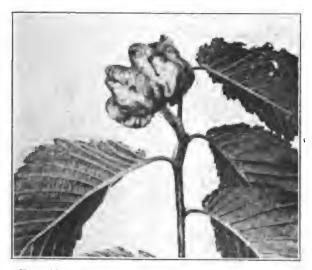


Fig. 130. Eriosoma pyricola; mature gall on cork elm leaf. (Original.)

The insects confine their attention almost wholly to the fibers and smaller roots, rarely infesting roots over half an inch in diameter. In this respect their feeding habits differ from those of the apple woolly aphis, which abundantly colonizes large as well as small roots. On pears the fibers are often heavily infested. Weldon (3) found fiber infestations to a depth of three feet. Serious infestations occur in late summer and fall at the bases of the current year's root growth and it is at this point that the fall-winged migrants are chiefly produced, often in great quantities. The aphids form their colonies in rings around the root, greatly weakening if not being instrumental in killing it. The two-year-old wood is likewise attacked, but much less often. It would appear that the nymphs of the migrants do more collective damage than do those of the wingless form. Roots on which large numbers of migrants have developed are very susceptible to decay through the rains of the winter following their infestation. This is presumably due to the impairment

of the outer tissues inviting decomposition and is a condition often encountered on heavy soils.

As concerns the woolly aphis the critical period in a pear tree's existence is that preceding the establishment of its root system in the orchard, and of this period the most critical time is the summer and fall following the planting of the tree in the orchard. On heavy soils there is still danger for three more years, yet every succeeding year finds the roots of the tree more tirmly established and the danger from aphis diminishes with time.

Seedlings disinfected before planting in spring are liable to bear heavy infestations at any place on their roots the succeeding fall, due either to having been planted in the nursery close to infested trees or to having received spring migrants from cork elms, a phenomenon which is discussed below. The spread of the aphis in nurseries is frequently rapid. The second year in the nursery may find abundant aphis on the trees now grafted. Nursery trees supplied with plenty of water and cultivation are rarely badly injured. When the trees are planted out in the orchard in the third or fourth year of their life they receive as a rule considerably less moisture than they were given the years previous in the nursery and are hard pressed to withstand a heavy infestation of aphis, especially on hard soils. This is the critical time in the existence of the tree and emphasizes the need for careful disinfection of stock before planting. Even if the trees are planted clean there is danger of infestation in June and July through the agency of the spring migrant form if cork elms occur in the neighborhood. The extent of this danger can not be measured accurately, but it is not great enough to justify foregoing the disinfection of infested nursery stock even if this is destined to be planted in close proximity to cork elms regularly infested with woolly aphis.

The French stock which has been used heretofore in the great majority of California pear orchards is very susceptible to aphis injury. The Kieffer, Japanese pear and quince stock are much more resistant, although the insect will thrive upon the two first as successfully as upon the French root. The relative immunity enjoyed by the Japanese stock has of late years led to its adoption in place of the French stock by many nurserymen. Wisker (4) reports on the resistance qualities of this root as found in the Loma Rica Nursery at Grass Valley, California.

Biology.

The life cycle of the pear woolly aphis is complicated, by reason of the fact that it has an alternate hose, the cork elm (Ulmus subcrosa, Doud). The aphis remains on the pear all the year in succeeding generations of wingless forms, but large numbers of those individuals developing between July and November mature as winged insects, forsake the pear roots, issue above ground and fly to elms, to deposit on the trunks about eight young, male and female. These take no food, molt four skins in about ten days and then the sexes mate, after which the female deposits in a crack of the bark or under a bud scale a single egg. The mature sexual insects are very small and bare. The male is dark green with a lilac mottling, the female orange or crimson. The egg is reddish. If healthy this egg hatches the following spring, generally in April, and the resultant aphis proceeds to settle on a young elm leaf. Its continued puncture in the tissue causes an abnormal growth of the leaf in the form of a thick-walled spiral gall, at first tightly closed. This gall grows larger for about two months, latterly becoming large and bag-shaped, wrinkled and ribbed on the outside and often includes the whole leaf. Mature galls vary in size and may measure as much as 41 inches maximum diameter. When daily exposed to sunshine they assume bright yellow and rosy hues. Galls that are hidden from sunshine remain green. In the fall all the galls turn brown before the rest of the leaves and most of them remain hanging on the trees throughout winter. This phenomenon is perhaps due to the fact that the peduncle of a gall-bearing leaf is greatly thickened and coupled with its abnormal weight presumably enables the leaf to withstand winds.

The aphis born from the egg lives its whole life in the gall and is the parent of a large progeny, most of which develop wings and forsake the galls in June and July. These are the spring migrants and they fly to pear trees, where they locate sometimes on the foliage, but more usually about the crown. They deposit about twenty-two young on a trunk and these strive to make their way down to the roots. The progeny of the spring migrant do not differ in structure from those of the wingless root form. They remain wingless and have the same habits as all the wingless root aphids. Hundreds of migrants are produced in the larger galls, but the developing nymphs have many natural enemies. Although the galls are

tightly closed at first, they open up when about half grown so as to permit entrance of predatory insects. Large numbers of the spring migrants become the prey of spiders, which are often abundant about the elm tree.

Judging from the number of trees planted and flourishing today the cork elm has been a favorite shade tree along roads, about ranch buildings and in towns in California. The aphis has thus been furnished with propitious conditions for its full development. There is little doubt that both spring and fall migrants can migrate comparatively long distances. The writer has found both forms well over a mile from their respective localities of origin and feels reasonably sure that they can travel much greater distances. Both forms are somewhat elongate, bare, dark green or brown, the disc of the abdomen shining and the body tipped with a small tuft of white "wool."

The Root-Feeding Form.

Relative abundance throughout the year.—During the winter months from December to March the aphis is scarce, occurring mostly on fibers. On trees which have been heavily infested the previous summer it is frequently hard to locate any aphis in winter. In April and May the numbers increase regularly. Occasionally, however, on lighter soils quite heavy infestations are encountered early in April. After May the increase in numbers is more rapid until September when the maximum numbers occur. In this month there is the greatest production of winged aphids and thereafter the numbers dwindle rapidly, although it happens at times that the production of migrants and maximum infestation is postponed as late as the end of October. As a rule relatively more migrants are produced in heavy than in light soils, and, therefore, in the latter there is a less noticeable diminishing in numbers, following the development of the migrants.

Biologic observations.—To secure laboratory data on the reproduction, development and habits of the root aphids so that conditions might approach those of nature the insects were bred on root sections kept in moist sand in a cellar. Almost invariably the aphids if disturbed moved off and refused to settle again on the desired piece of root and, therefore, unless they were let alone records could not be secured. This resulted in many incomplete records, as the small roots dried up and the insects departed before full development or before the deposition of the full quota of young. Individual reproduction varied from 90 young in 33 days to 18 young in 28 days. The average number denosited by an individual was 40 and the daily average J.6, yet on several occasions 7, and in one 8 young were extruded within 24 hours. Toward the end of the deposition period days were frequent on which no young were deposited, and this explains the small average daily reproduction.

The newly-hatched root aphis is elongate in shape, yellowish pink in color, and After a few hours' feeding rows of little white wax tubes appear over the These grow into hollow filaments and attain their maximum length not until several days have elapsed. The wax filaments or threads in the first instar may become as much as eight times the length of the aphis. Just preceding each molt these threads break off at the base and after the skin is molted the body is quite bare and the threads grow out anew. In the later instars the threads are never over three times the length of the insect's body. Four molts occur before the aphis is mature and after each molt the color of the newly-molted individual is darker than at the one previous so that the adult insect is at first reddish brown. It is elongate pyriform in shape and about two mm. in length and one mm. maximum The body color soon becomes pink, and later, preceding the insect's death, turns dark red. Not until four or five days after the molt do the wax threads attain their full length, which is barely twice the length of the aphis. The threads have a tendency to curl and split at the end, and when not forecasting a molt their breaking off at the base is a sign that the aphis is getting inadequate nourishment or is moribund.

During the winter months the root aphis is in a state of virtual hibernation. Specimens in all stages of growth collected in December showed no activity until February, when the larvæ molted and the adults began the deposition of young. The insects pass the winter in any stage, but it is hardly a true hibernation, rather an unusual prolongation of stages and cessation of reproduction. During the spring months the aphids developed in an average of four weeks varying from 20 to 35 days. In June this period was hardly shortened, but in July, August and September the average dropped to 18 days with a minimum of 13. In

October the developmental period increased again to 25 days, in November to 5 weeks, while in the winter months it was prolonged to 2½ months. The rate of growth is at all times closely dependent on the condition of food coupled with influences of temperatures. The first instar is invariably the longest; generally it is nearly twice as long as any of the other three larval instars, which are of about equal length, but frequently in the breeding dishes the young aphids had trouble finding desirable locations and lost considerable time in becoming settled, thereby prolonging the period of the initial stage to a considerable extent. Once the larvae became settled they did not move away unless the quality of their food deteriorated.

All attempts to colonize apple or cork elm roots failed, yet the apple woolly aphis was raised on pear roots, French, Japanese and Kieffer; but it appeared that



Fig. 131. Eriosma pyricola; old dry gall on cork elm leaf. (A. C. Baker.)

they did not develop as successfully on these as upon apple roots, and no swellings were caused to form on the pear roots. The pear woolly aphis was raised with as good success on Japanese and Kieffer roots as upon French. In most cases it failed to feed on quince roots.

There are as many as ten wingless generations a year on pear roots. Compared with other aphids the rate of reproduction is slow, yet this rate does not compare unfavorably with that of the apple woolly aphis. Baker (5) found that the wingless females of this species deposited on the average 30 young at the rate of 3 per diem. The pear woolly aphis feeding on roots somewhat below the average in quality averaged 40 young at the rate of 1.6 per diem.

The root aphids suffer but little from natural enemies, a single Soymnus larva being the only predator observed by the writer, while no parasitic enemies were ever encountered. The young larvæ are very flat and without doubt penetrate the soil throughout the root system. Also the aphids can live under extremely moist conditions, provided the roots are not decayed.

Control.

Trees may be safely disinfected in airtight houses or boxes with hydrocyanic acid gas. Three quarters of an ounce sodium cyanide or one ounce potassium cyanide should be used for each 100 cubic feet of air space within the fumigatorium and fumigation should last 45 minutes. For orchard treatment a contact insecticide that will dissolve the wax secretions is desirable. This should be applied in a shallow basin around the trunk. Experiments with miscible oil, kerosene oil emulsion and distillate oil emulsion proved successful. Miscible oil was used at strengths of 1/12, 1/20, 1/28, and 1/40. The two first proved successful and the third partially so. At strengths of 1/12 and 1/20 occasional burning of surface roots resulted, but the main roots escaped injury and for three months after treatment the infestations remained very small. Kerosene oil emulsion was tested at three strengths, 10, 15 and 20 per cent. Three months after the applications all the treated trees with one exception were free from aphis to a depth of one foot, the exception consisting of one small colony on a tree treated with 15 per cent emulsion. Three check trees were heavily infested. At 15 per cent and 20 per cent strengths some surface roots were burned. Treatments with distillate oil emulsion included strengths of 1½ per cent, 3 per cent, 4½ per cent and 6 per cent. Yearling orchard trees were given one gallon of wash. Except for the weakest strength results showed that the aphids were killed as far down in the soil as the insecticide penetrated, in most cases all the insects on the tree were destroyed. In other cases, however, those on the lower roots were not killed and it was evident that one gallon was not quite sufficient to reach the lowest roots.

Carbon bisulphide 30 cc., 20 cc., and 10 cc. per tree was applied with a pal injecteur to yearling orchard trees. Each application was made from 8 to 12 inches from the tree trunk, was of 5 cc. charge, and was released 6 inches below the soil surface. The condition of the soil was good for this treatment. Examination made ten days after treatment indicated that 10 cc. was not satisfactory, and that at the two other strengths the aphis were either killed or weakened and discolored, except that out of the four trees treated with 20 cc. one had a small healthy infestation on fibers 14 inches from the soil surface. The use of carbon bisulphide in the orchard is somewhat risky, occasional trees having been killed outright from treatments of 30 cc.

Nursery seedlings treated with one injection of 6 cc. carbon bisulphide injected six inches from the trunk and about five inches below the soil surface were freed of aphis. Even as small a dose as 2 cc. destroyed all the aphids on 5 out of 6 trees. Injections made one foot from the trunk were ineffective. The seedlings were treated in October and no ill effects on the trees could be traced to the insecticide. However, at this time of year the trees were growing but little, and had they been treated earlier in the year when the trees were in full growth root injury might have resulted. If nurseries are to be treated in summer with carbon bisulphide a few trees should first be tested for possible injury.

The writer believes that trees infested with the woolly aphis should receive treatment in April or May and should be examined during July and August and if necessary treated again. In most cases a single application will not kill or drive off all the root aphids on a tree so that in course of time the infestation will increase again. In the treatments with kerosene oil emulsion and miscible oil it was found that this subsequent increase was very slow—three months after the application in no case could an infestation of injurious proportions be found. A yearling orchard tree requires from 1½ to 2 gallons of insecticide, older trees up to four years require about a gallon for each year of their age, but the amount varies with the manner of root growth, trees with deep roots requiring more wash than those with shallow roots. Trees over four years of age rarely need treatment and thorough treatment of them is rendered difficult by reason of the spread of the root system.

Summary.

The pear woolly aphis is distributed throughout the pear-growing districts of northern and central California.

Injury of marked degree is chiefly confined to trees under five years of age; trees the first and second years of their existence in the orchard suffer most severely, the more weakly individuals either being killed outright or more often exhibiting degrees of stunted growth.

The injury is most severe on heavy soils that bake in summer and least severe on sandy soils.

The aphis lives the year around on the roots of pear, but may also spend the winter and spring months on the European and cork elms, where it forms characteristic baglike galls on the leaves. The journey from pear to elm and vice versa is performed by winged aphids which are capable of traveling considerable distances. The wingless forms on the root develop very slowly in winter and in midsummer develop in as short a time as two weeks. In spring and fall the developmental period is roughly a month, but varies according to season.

Miscible oil, kerosene oil emulsion and distillate oil emulsion were used at proper strengths with success in controlling aphis on the roots of young orchard trees. Carbon bisulphide injected into the soil in liquid form with a pal injecteur proved satisfactory, both on young orchard trees and in the nursery. There is some danger to the trees in the use of this insecticide.

The application of manure around the trees on the soil surface helps to conserve moisture and assists in combating the aphis on heavy soils with a baking tendency.

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THE MONTHLY BULLETIN

CALIFORNIA STATE COMMISSION OF HORTICULTURE.

DEVOTED TO HORTICULTURE IN ITS BROADEST SENSE, WITH SPECIAL REFERENCE TO PLANT DISEASES, INSECT PESTS, AND THEIR CONTROL.

Sent free to all citizens of the State of California. Offered in exchange for bulletins of the Federal Government and experiment stations, entomological and mycological journals, agricultural and horticultural papers, botanical and other publications of a similar nature.

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Mealybug Control.

Through the efforts of the citrus growers of southern California the State Board of Control, with the approval of Governor Stephens, has set aside from their emergency fund the sum of \$5,000 for the use of the Commissioner of Horticulture in the mealybug campaign. At the time our budget was submitted in the fall of 1916, the urgency of work against the citrophilus mealybug was not apparent, hence was not included in our estimate. The action of the Board of Control in coming to our rescue is greatly appreciated by the growers, as is shown by numerous letters and telegrams which we have received. The fund will be mainly expended through the branch insectary and will be used first in work with natural enemies and the control of the Argentine ant, and, secondly, in a demonstration of orchard control methods in cooperation with the Citrus Experiment Station, under the direction of Professor Quayle. We expect to appoint an experienced field man who thoroughly understands the citrophilus mealybug, and place him directly in the orchards. The Commissioner of Horticulture will be responsible for parasite and ant work, the Citrus Experiment Station for orchard control. We believe that this arrangement will prove of greatest economic value to the growers whose orchards are infested, since the entire field of control will be covered thoroughly.

Crop Reports.

With an organization consisting of forty-seven county horticultural commissioners, in as many counties of the state, who are required by law to make reports to the office of the State Commissioner of Horticulture when requested to do so, this commission is in a position to secure data that perhaps could not be gathered through any other source. At times, as would naturally be expected, the accuracy of certain reports is questioned. This, we believe, should not deter us in our effort to get these reports before the public, but should simply put us on our guard so that we may be able to detect inaccuracies and to perfect our system, profiting as we go along by the unavoidable errors which are occasionally made.

For the past four years the task of compiling this report has been in the hands of Chief Deputy Coorge P. Weldon. The work has been simplified and systematized so that early each month a comprehensive report of the crop condition is compiled covering, ach county where a commissioner is employed; and also in addition two counties having no commissioner, viz: Solano and Napa. In these two

cases Farm Advisers J. W. Mills and H. A. Baade have very kindly rendered a similar report to that received from the commissioners. Mr. Butler has recently been appointed commissioner in Napa and we hope to soon have Solano County again represented by a commissioner.

A new feature of the report printed this season is a state average condition. This average is based on the relative production of each fruit in the different counties, and is therefore a true state average. Another year an interesting comparison can be made between the state average at any given time during the season and the same time the previous season.

In addition to the condition report issued, a revised table of the acreage of each fruit, both bearing and nonbearing, is printed for each county. An attempt will be made to secure for the first time this season accurate figures on the production of every fruit grown in the counties represented in our crop report. If this attempt succeeds and similar figures can be secured each season for a series of years, the condition report will be more and more valuable as figures can be given showing what constitutes a normal crop.

G. H. H.

Lemon Outlook Better Than First Reported.

The California Fruit Growers Exchange, through Assistant Manager Drezell, has reported to this office that the lemon trees have bloomed since the heat wave and from March on fruit from this bloom will be produced. According to Mr. Drezell pickings during the early months of 1918 will be extremely light, as the fruit that would mature then was very small in size at the time of the excessive heat, and dropped off to a great extent except in districts very near to the coast. G. H. H.

Spray Injury.

There appears in this number of the Bulletin an article on injury to apples from sulphur sprays, by County Horticultural Inspector J. B. Hundley of Yucaipa. This article brings out very clearly the fact that under certain climatic conditions, and when trees are low in vitality, injury may result that is very severe. In case of injury there is usually a correlated complaint in the nature of an attack upon certain persons who advised the use of the spray which caused the injury. Naturally it is an unpleasant experience, to say the least, to have a crop of fruit badly injured in this manner; but the attacks upon those who have given the best information available are often unwarranted. Spraying with any insecticide or fungicide is more or less unsafe, especially during the summer season, and injury from Bordeaux mixture, arsenate of lead, lime sulphur, etc., frequently takes place. Such injury is no argument against spraying without which we could not possibly grow good fruit, but rather is an argument in favor of every possible precautionary measure. The injury described in Mr. Hundley's paper could not have been prevented because the excessive heat was equally responsible with the sulphur. The combination which resulted in so much injury might not happen again for years. There is a well-founded theory that trees develop immunity to sulphur injury as the season progresses providing that they have been treated early in the season with one or more lighter sprays. In other words the maximum strength of a sulphur spray if applied to trees during the summer, that have not been previously sprayed with a lighter dosage, are very apt to be injured.

Frequently the injury, as in the case described by Mr. Hundley at Yucaipa, seems greatest immediately after the burn shows on the foliage and fruit. Later it may be discovered that the loss of all the injured fruit was a means of thinning the crop with a resultant good effect.

G. P. W.

Horticultural Quarantine and Citrus Canker.

It would be hard indeed to find a better instance of the value of an adequate quarantine service, with an intelligent and efficient inspection of incoming horticultural products than is afforded by some of the southern states today engaged as they are, in the herculean task of eradicating citrus canker. In Florida since this disease was first discovered and recognized a large force of trained inspectors has been constantly employed in the groves and nurseries. To organize, train and maintain a force of upwards of three hundred men, each man a specialist, has been and is no small task and is a feature of the work in Florida of which any state might well feel and.

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Unfortunately it is seldom given to any of us to foresee the particular form in which calamity proposes to strike. Had it been possible for the fruit grower of Florida a few years ago to look into the future and see his trees attacked by a disease so destructive as to make him willingly consent to the removal of all trees found infected in the hope of saving the remainder, how long do you think it would have taken him to devise a means whereby with only a small part of the energy, time and money which has subsequently been spent, another force of men could have been organized and trained into an efficient and thorough quarantine service having as its duty the exclusion of just such enemies to his continued prosperity as is citrus canker.

It is true, citrus canker was an unknown disease in 1910 when the nursery stock on which it was introduced into Florida crossed the state line and was set out in the citrus growing sections of the state. Granting as a possibility, what is by no means a probability that the trees carrying this disease might have passed the inspection of qualified inspectors there would still remain an item of inestimable value for the work of eradication in the records showing the number of such trees imported, from whence they came and where they found their ultimate destination. Had this information been available for immediate use by the citrus canker eradication forces of Florida in the early days of the campaign the saving in energy, time and money would have many times over offset the cost of maintenance of the quarantine service.

A. S. HOYT.

COUNTY COMMISSIONERS' DEPARTMENT.

SAN FRANCISCO'S MODEL GARDENS.

By Dudley Moulton, County Horticultural Commissioner, San Francisco, Cal.

San Francisco has in her own way set an example to agriculturists all over the state. There is almost no extended acreage within the limits of the city and county that can be used for agricultural purposes, but there are hundreds of back yards suitable for small gardens. The local Council of Defense knew that the regular plan for an increased planting in a large way could not be applied here, so they



Fig. 132. Model Gardens on the grounds of a Standard Oil service station in San Francisco. The product of Standard Oil Gardens is turned over to the associated charities free. (From Stand. Oil Bul.)

started a movement to help city dwellers. Model garden plots were established in many parts of the city. These were intended as object lessons for those having little experience and there has been a remarkable interest taken in these gardens. The produce from the city gardens is being sent to the San Francisco hospitals.

A most remarkable example has been made by the Standard Oil Company. The service stations throughout the city have been models of beautiful lawns and attractive ornamental flowers. Now all stations that had sufficient area are flourishing vegetable gardens and models in every sense of the word. The best science of gardening has been applied. The lawns were spaded under, loam and manure added, a thorough seed bed prepared, and vegetables of all kinds were planted. These were grouped with an idea of rotating crops and of utilizing all available space. All are planted in straight rows and labeled to instruct city dwellers. Now, after seven weeks, vegetables are picked every day and delivered

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Fig. 133. Service station gardens showing the descriptive signs placed on the plots for the benefit of the San Francisco back-yard gardeners. (From Stand. Oil Bul.)

to the Associated Charities and various other church and benevolent organizations. The Standard Oil Company has done all this at their own expense and donates the produce.

Back-yard gardens have been planted everywhere and a wholesome determination has entered the heart of San Francisco to do her part in producing and conserving food products. While the acreage is comparatively small, still the resulting produce is a large addition to the food resources of the city, for in intensive gardening the principal factor is the labor devoted to the care of the gardens, and San Francisco by planting back-yard gardens is devoting thousands of hours of labor to food production which would otherwise be lost.

SULPHUR INJURY IN YUCAIPA, 1917.

By J. B. HUNDLEY, County Horticultural Inspector, Yucaipa, Cal.

Before entering into a discussion of the points brought out in the following survey, covering every orchard in the Yucaipa Valley which was sprayed before June 20, 1917, it seems wise to state the weather conditions prevailing during the week June 12 to 19. All in this section will remember that the hot wave of that period was unprecedented in recent years. Not only was the temperature 10 degrees higher than ever before known in Yucaipa, but the heat was also accompanied by a desert wind, which was very dry as well as hot. Another unusual feature which rendered the trees more subject to injury was the fact that the hot spell followed a very cold rainy spring. Nearly the entire month of May was cold and wet.

Maximum temperatures—June 5 to 20:

June 5, 80	June 9, 86	June 13, 100	June 17, 112
June 6, 80	June 10, 79	June 14, 106	June 18, 101
June 7, 81	June 11, 81	June 15, 109	June 19, 98
June 8, 90	June 12, 91	June 16, 111	June 20, 92

I am emphasizing these weather conditions because they seem to be the controlling element in this spray injury. During the four years we have been combating codling moth, red spider and mildew, we have used exactly the same sprays each season and have never before burned or injured the fruit in any way. Two cases come to my mind of previous years where sulphur alone caused some leaves to fall. In both cases there was absolutely no injury to fruit, and in both cases the sulphur was applied under hot dry conditions, the temperature being 100 degrees.

During this 1917 spray period, namely, May 28 to June 7, the weather was ideal in that the temperature did not exceed 81. In fact, no injury was apparent until the fifth day of the hot spell, which was from ten to twenty days after the spray was applied.

In the chart only the spray applied prior to June 20 is shown. Those orchards a record of which is preceded by a star did not receive the third spray, but only a second, which followed the calyx spray in about ten days. Other orchards recorded were sprayed twice before the spray indicated, namely, in the calyx and ten days later. In these the date of spray therefore means the date the orchard received its third spray. In practically all cases where injury resulted from either the calyx or the spray ten days later, sulphur was used in the calyx spray, as in Nos. 8, 9, 10. This injury was very much more pronounced on the Rome Beauty than in other varieties and resulted in a small black spot developing around the calyx. It is quite remarkable that this injury should have developed sixty days after the spray was applied. In all cases of injury of fruit in orchards preceded by a star this injury was around the calyx as described.

The damage was estimated shortly after the hot spell and before any thinning, which was absolutely necessary in many cases, had been done. Because of this fact the net returns from orchards with a loss in fruit as high as 20 per cent were not affected, as all injured fruit was removed in thinning and enough was left for a good crop. This spray injury was most severe on the southeast side of the trees. It caused large numbers of leaves to fall and burned the fruit to a crisp, where exposed to the sun. In a week the apples showed burned depressions one-fourth of an inch deep. The stem did not seem to have been injured, so the fruit continued to develop around the burned area until it was badly misshapened. Finally the burned area cracked, but the fruit did not drop.

Another interesting feature brought out is the difference in susceptibility of varieties. The White Winter Pearmain burned the worst, with Gano, King David and Jonathan close seconds. The next most susceptible varieties were Winter Banana, Winesap and Delicious. The Rome Beauty seemed most resistant except in case of the calvx injury described.

Taking up the combinations as set forth in the table, we find that practically every case where sulphur was used injury resulted. The brand of sulphur used, whether "Atomic," "Sul-paste" or "Milled," seemed to make very little difference. In the case of orchards numbered 95 to 100 where dry sulphur was mixed in the

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spray tank with arsenate of lead and soap, the high per cent of damage seemed due more to the orchard condition, variety of apple and method of application, than to the material. Orchards numbered 114, 115 and 116 were sprayed with dry sulphur also, but with very little injury. In looking over the table you will not find a case where arsenate of lead either alone or with soap caused any appreciable injury. On the other hand orchards numbered 67, 68, 69 and 119 did not have soap in any form and the injury was great. Orchards numbered 57, 60, 62, 81, 82, 83 and 102 all furnish good illustrations of where sulphur was used on part of the orchard, but not on the entire orchard. In these cases the work was done by the same outfit on the same day, but with considerable difference in results.

In the case of orchards numbered 67, 68 and 69 no soap was used, and in 67 and 69 the sulphur was decidedly below strength, still the injury was severe. These few instances will serve to show that the sulphur was the element which seemed to cause the injury. Many other equally interesting instances could be shown of variations due to orchard conditions, locations and vitality of trees if space permitted.

From a careful study of the facts as they appeared it seems that there is an element of danger in the use of sulphur in any form during the growing period. This spraying was all done under favorable conditions which continued for several days. The arsenate of lead-sulphur-soap spray seems fairly safe in dry climates, provided the temperature does not exceed 100 degrees; above that temperature there seems to be an element of risk. Orchards in the lower valleys either sprayed or unsprayed where the temperature was 5 to 8 degrees higher were burned. This indicates that all orchards, sprayed or unsprayed, were very near the point of damage from excessive heat and that in some cases the sulphur proved just enough to cross this line.

Another quite noticeable feature is that the most severe burning occurred on orchards where the vitality of the trees was low. This might have been caused by poorer soil, lack of proper moisture or other unfavorable soil conditions. Two of the worst burned orchards had not been plowed, and consequently were dry.

From the table on pages 404-407 it seems quite certain that this injury was caused by a combination of conditions, namely, sulphur, lack of tree vigor and heat.

О ≅ ша де	NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN	3% NNOUS NOUS NOUS NOUS NOUS NOUS
Date last irrigation	1916 1916 1916 1916 June 15 June 29 June 4 June 4 June 6 June 6 June 6 June 6 June 6 June 6 June 1916 June 1916 June 1916	June 18 May 12 May 12 June 8 June 4 June 22 June 14 June 15 June 15 June 15
Soll condition	Fair Fair Fair Fair Pood Good Good Good Good Good Good Good	Fair Fair Alfaifa Good Fair Fair Good Good Good
Brand soap (Amt. per 100 gala.)	Fish oil, 3 lbs. Fish oil, 3 lbs. Fish oil, 3 lbs. Fish oil, 4 lbs. Fish oil, 3 lbs.	Fish oil, 4 lbs. Whale oil, 4 lbs. Fish oil, 4 lbs. Fish oil, 4 lbs.
Brand sulphur (Amt. per 100 gals.)	Atomic, 10 lbs. Atomic, 10 lbs. Atomic, 10 lbs. Sul. Paste, 10 lbs. Sul. Paste, 10 lbs.	Atomic, 10 lbs. Atomic, 10 lbs. Atomic, 10 lbs. Atomic, 10 lbs.
Brand arsenate of lead (Amt. per 100 gals.)	O. Dry, 2 lbs. S. Dry, 2 lbs. S. Dry, 2 lbs. O. Dry, 2 lbs.	C. Dry. 24 lbs. C. Dry. 22 lbs.
Date spray	May 30 June 4 June 4 June 2 June 4 June 6 June 6 June 6 June 6	May 12 May 11 June 1 June 15 Apr. 30 May 14 June 2 June 2 June 6 Apr. 23 Apr. 23 Apr. 23 Apr. 23
Or- chard No.	12 64700 5 8 6 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	នៃនៃនេ ងនៃនេសនេច និ <mark>ងនិង</mark>

2% None None 1%	1% None None None 10% 1%	1% None None None	3% None None None None	None 5% None None 25% 15% 3%-15% 5%-15% None	None 25% 2%
June 2 1916 May 19	June 11 1916 June 23 June 14 June 14 June 14	June 22 June 10 June 3 June 19	June 13 June 12 June 13 May 22 June 27 June 12 June 5 May 21	1916 1916 1916 June 8 June 19 June 22	May 25 June 4 June 6
Poor Good Alfalfa	Good Fair Good Fair Fair Fair	Good Good Good	9000 9000 9000 9000 Fair 9000 9000	Good Good Good Good Good Falr	600d 600d
of1, of1,	Fish oil, 4 108. Fish oil, 4 108. Fish oil, 4 108. Fish oil, 3 108. Fish oil, 3 108. Fish oil, 4 108. Whele oil, 4 108.	. !	Fish oil, 3 lbs. Fish oil, 3 lbs. Fish oil, 3 lbs. Fish oil, 4 lbs. Whale oil, 4 lbs. Whale oil, 4 lbs. Whale oil, 4 lbs. Fish oil, 4 lbs. Fish oil, 4 lbs.	Fish oil, 4 Fish oil, 3 Fish oil, 4	Fish oil, 4 lbsFish oil, 4 lbsFish oil, 4 lbs
의 의의	Atomic, 10 lbs. Atomic, 10 lbs. Atomic, 8 lbs.	3		Atomic, 10 lbs Atomic, 10 lbs Lusting sul. mixed with soap hot, 5 lbs. Dusting sul. mixed with soap hot, 5 lbs. Atomic, 10 lbs	Sul. paste, 10 lbs Sul. dusted on after spray.
25 C. Dry, 22 lbs. 12 C. Dry, 22 lbs. 12 C. Dry, 24 lbs. 1 C. Dry, 22 lbs. 15 C. Dry, 22 lbs.	2 C DTy, 22 Dbs. 14 C DTy, 22 Dbs. 16 C DTy, 22 Dbs. 17 C DTy, 22 Dbs. 18 C DTy, 22 Dbs. 17 C DTy, 22 Dbs. 18 C DTy, 22 Dbs.	4 C. Frate, 3 105	2 C. Dry, 22 lbs. 1 C. Dry, 22 lbs. 1 C. Dry, 22 lbs. 2 C. Dry, 22 lbs. 2 S. Dry, 22 lbs. 3 S. Dry, 22 lbs. 4 S. Dry, 22 lbs.	2 C. Dry, 24 lbs. 2 C. Dry, 24 lbs. 11 C. Dry, 24 lbs. 4 C. Dry, 24 lbs. 1 C. Dry, 24 lbs. 1 C. Dry, 24 lbs. 2 C. Dry, 24 lbs. 3 C. Dry, 24 lbs. 4 C. Dry, 24 lbs.	යකස _ ධුරාධ
			47 June 48 June 50 June 51 May 53 May 53 May 54 May		63 June 64 June 65 June

Demage	15% 10%, some	Trees 50% 10% 70%	66.6 24.2 24.2 24.2 24.2 24.2 24.2 24.2	None	5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5	None	None	None	None Fac	None	10%	200 M	1%	1% 1%	5.00 LB	None	1% 9-5%	20%
Date last irrigation	June 18	1916	1916	OTAT		1916	1916	May 23	June 19	June 20	June 15	June 12	June 10	June 13	1916	May 30	1916 June 29	May 26
Soil condition	Good	Good	Good	Fair	Fair Good	Poor	Poor	Fair	Fair	Good	Good	Fair	Dry	Good	Poor-Dry	Good	Good	Fair
Brand coup (Aust. per 160 gala.)	Fish oil, 4 lbs.		Whale oil, 24 lbs Whale oil, 4 lbs	Whale oil, 3 lbs.	Whale oil, 8 lbs.	Fish oil, 4 lbs.	. :-	Fish oil, 4 lbs.	Whele oil, 4 lbs.	Whale oil, 4 lbs.	Whale oil, 4 lbs.	ee-	Figh oil, 4 108	Whale oil, 4 lbs.	Whale oil, 3 lbs.	Fish oil, 3 lbs.	4-	Fish oil, 8 lbs.
Brand sulphur (Amt. per 100 gals.)	Sul. paste, 10 lbg	Milled, 10 lbs	Atomic, 3 lbs	Atomic, 4 lbs	Atomic, 10 lbs.		Spray sul.	Atomic, 10 lbs.		The state of the s	Sul. paste, 10 lbs.	Sul. paste, 10 lbs.	Atomic, 10 lbs.	Sul. paste, 10 lbs.	Sul paste, 10 lbs.		Sul paste, 10 lbs.	Flowers sul. mixed in tank, 5 lbs.
Brand arsenate of lead (Amt. per 100 gala.)	O. Dry, 24 lbs. C. Dry, 34 lbs.	C. Dry, 24 lbs.	-===	S. Dry, 3 lbs.	S. Dry, 3 lbs. C. Dry, 24 lbs.	Dry. 24	Dry 22	Dry, 21	S. Paste, 5 lbs.	S. Paste, 5 lbs.	Paste, 5	S. Paste, 5 lbs.	Dry	Paste, 5	S. Dry, 2, 108	Dry 200	27.	Dry, 25
Date spray	May 27 June 12	June 1-5	June 8	Apr. 23	June 4	June 6	June 8	May 16	June 4	June 5	June 5	June 3	May 12	May 15	June 6	June 1	May 12	June 2
Page No.	86	88	3828	185	2.5	213	% % 0	\$ 2	\$ &	3 8	8 3	6 6	8	8 8	ō %	88	328	8

None 85% 50%	30%	25%	%09	20%	45%	15% 15%	None	None	None	None	75%	None	None	None	% % %	1%	None	10% 12% 15%
June 7 1916	1916	June 27	June 18	June 20	June 21	June 18	June 12	May 16	June 19	June 1916	Never	1916	June 20	June 8	June 20	June 17	June 15	1916 1916 1916
Dry Dry Very dry	Dry	Dry	Dry	Dry	Fair	Good	Good	000g	Fair	Fair	Dry	Fair	77	Good	Fair	Good	Good	Good
Fish oil, 3 lbs. Whale oil, 3 lbs.	Whale oil, 3 lbs	Whale oil, 3 lbs	Whale oil, 3 lbs	Whale oil, 3 lbs	Whale oil, 3 lbs	Whale oil, 4 lbs.	011,3	Fish oil, 4 lbs.	4	Figh oil, 3 lbs	Whale oil, 3 lbs.	Whale oil, 3 lbs.	Fish Oil, 4 Ibs.	Fish	Figh oil, 4 lbs.	Fish oil, 4 lbs	Fish oil, 4 lbs.	Fish oil, 34 lbs. Fish oil, 4 lbs.
Atomic Anchor sul, mixed in	Anchor sul. mixed in	Anchor sul. mixed in	Anchor sul mixed in	Anchor sul mixed in	Anchor sul mixed in in tank 5 to 6 lbs	Milled, 12 lbs					Sul. paste, 10 lbs.		Atomic, 10 lbs	Atomic, 10 lbs.	Atomic, 10 lbs	tank, 9 lbs. Dusting sul, mixed in	tank, 9 lbs. Dusting sul, mixed in	tank, 9 lbs. Atomic, 10 lbs Atomic, 10 lbs
O. Dry, 24 lbs. O. Dry, 24 lbs. S. Dry, 24 lbs.	S. Dry, 24 lbs	S. Dry, 24 lbs	C. Dry, 24 lbs	C. Dry, 24 lbs	O. Dry, 24 lbs	S. Dry, 5 lbs	. P. J.	C. Dry, 24 lbs	Dry. 2		Dry. 24	Dry, 24		Dry, 24 1bs.	21 lbs. 21 lbs.	C. Dry, 24 lbs.	O. Dry, 24 lbs	24 lbs.
4 May 28 May 28 June 8	96 June 2	7 June 4	8 June 7	9 June 5	9 June 8	May 3	e une		May	June	Ju. 7	June	May	May	June		f June 5	7 May 29 8 May 30 9 June 2
% %	5	97	88	8	901	101	ž	5	Ş	<u> </u>	3	9	==	ij	113	115	116	117 118 119

O. Dry-Corona dry arsenate of lead.

8. Dry-Swift's dry arsenate of lead.

8. Paste-Swift's paste arsenate of lead.

WORMY PEARS ARE CONDEMNED IN SACRAMENTO COUNTY.

By FRED C. BROSIUS, Deputy County Horticultural Commissioner, Sacramento, Cal.

The season of 1917 will always be remembered in Sacramento County for its enormous yield of pears and also the great amount of codling moth worms. The exact cause of this uncommonly large infestation may never be known, as the worms appeared in unusual numbers in many orchards where the several sprayings were carefully done, while in orchards where indifferent or no spraying was done, as high as 90 per cent of the pears were infested at picking time.

About 85 per cent of the entire pear crop from 5,100 acres in this county is shipped by boats to the Sacramento dock, and there transferred into refrigerator cars for Eastern shipment. It is on this dock that most of the fruit inspection

is carried on.

About the twenty-third of July the inspectors noticed that the amount of infested or wormy pears, per packed box, began to increase in many of the growers' packs, and as soon as possible these growers were visited and warned to sort the pears before packing. However, by July 29, the infestation per box was so great that it became necessary in several cases to condemn the entire lot and require that it be sorted and repacked on the dock before sale or shipment. This caused the shipping companies much inconvenience and the growers considerable additional expense, but it was thought that only in this way the growers could be brought to realize the true condition of their pack. The number of pears in from one to four boxes in each shipment was counted.

At the close of this article is a memorandum showing the percentage of infestation of each box counted, together with the number of boxes of each shipment condemned. Letters are used to designate shipments instead of the growers' names, each shipment by the same grower being designated by the same letter. It will be seen that some growers cleaned their pack after the first condemnation, while one grower had four different shipments condemned, and ceased shipping wormy fruit only when threatened with arrest.

No pears were condemned after August 10, for many growers, realizing the futility of getting the pears passed by our inspectors, either ceased packing entirely or sent their entire shipment to the canneries.

No arrests were made this season for several reasons, greatest of which was the incompetent labor used both during the spraying season and at harvest time.

It is our intention in the future to endeavor to allow not over 3 per cent infestation in any packed box of pears. However, there is one reprehensible practice which must be discontinued. This is the dumping of these wormy fruits into the local and San Francisco markets. The results of this practice are certainly bad for the careful grower, who sprays well and puts up a good pack, free from worms, but not quite good enough for Eastern shipment, and it is considerably worse for the consumer who expects to buy wholesome fruit, but, unknowingly, obtains an additional bargain in worms.

One fruit-shipping company, after sorting and repacking, and against the remonstrances of myself, shipped 52 lug boxes of these wormy pears to San Francisco. It can be imagined in what condition these arrived, being 100 per cent wormy. Fortunately, the San Francisco Board of Health condemned this particular shipment. To illustrate the feeling of the commission men in this matter I quote herewith a letter from a dealer in San Francisco to State Horticultural Commissioner G. H. Hecke, as follows:

"San Francisco, August 9, 1917.

"As far as we are concerned you can depend on it that we will gladly cooperate with either your office direct or with any office or officer in an effort to properly carry out the letter and spirit of the law referred to. (Standard Apple Act.)

"There is only one point that I regret, and that is that the law doesn't include other fruits besides apples. A mistake was made when pears and other fruits were not included, although there may be a law on the books at present that covers pears. If so, would you be kind enough to give me some reference.

"My reason for asking this is that the market is blocked at the present time

with a lot of No. 2 Bartlett pears, not only from the Sacramento River, but from other points as well, and almost all of this No. 2 fruit is wormy, and consequently checks the movement of green fruit that would otherwise sell at a satisfactory price.

"I know that our firm as well as other dealers in this market would be glad if this No. 2 or wormy stock could be condemned, because as matters now stand it permits growers who make a practice of not spraying their orchards to have an outlet for at least a fair market for their fruit, while the grower who pays attention to spraying, etc., has one of the best markets in the United States absolutely shut off from him.

"We claim that if the San Francisco market would not be made the dumping ground for every bit of No. 2 fruit that is raised in this end of the state it would prove to the grower who takes care of his orchard and who tries to put No. 1 fruit on the market that San Francisco would be one of the best markets for him that could be found anywhere in the United States."

Shipper	Date	Worm-free pears	Wormy	Total pears per bux	Per cent worms	Number boxes con- demned
A	July 29	120	45	165	27	11
A	July 29	93	72	165	48	
B	July 29	102	55	157	35	8
В	July 29	81	78	169	40	
Ċ	July 30	107	73	180	40	6
Ē	July 30	128	52	180	29	6
D	July 30	134	16	150	10	
D	July 30	120	25	145	17	17
D	July 30	124	31	155	20	
Α	July 30	74	90	164	54	5
F	July 31	55	98	153	65	3
G	July 31	110	48	158	30	8
Ğ	July 31	106	48	154	29	
Ā	July 31	72	91	163	55	9
Ā	July 31	126	39	165	23	
Ĥ	July 31	97	68	165	41	14
Ĥ	July 31	105	64	168	39	
ĩ	August 1	121	43	164	25	6
Ì	August 1	121	38	159	24	
ŕ	August 1	43	120	163	73	6
Ċ	August 1	88	77	165	40	17
č	August 1	72	91	163	56	
Ĭ	August 2	18 :	124	142	87	1
ĸ	August 2	134	45	179	25	. 4
F	August 2	33	132	165	80	3
F	August 2	50 .	101	151	60	
Ĺ	August 3	86	47	133	35	7
Ĺ	August 3	98	46	144	32	
E	August 3	112	53	165	32	2
M	August 3	137	43	180	23	l
M	August 3	91	72	163	44	18
M	August 3	91	74	165	45	
M	August 3	93	70	163	52	
Ñ	August 3	102	40	142	28	
Ñ	August 3	134	19	153	12	
ö	August 3	132	31	163	19	
ŏ	August 3	133	30	163	19	4
ö	August 3	135	37	162	22	
Ρ̈́	August 3	146	104	247	42	1
Þ	August 3	109	143	252	56	i
.J	August 3	12	138	160	86	2
Ÿ	August 4	155	52	207	29	4
Ř	August 4	104	63	167	37	1
\ddot{s}	August 4	82	43	125	34	10
S	August 4	83	51	134	37	
Ğ	August 4	139	16	155	10	7
Ë	August 4	133	17	150	11	1
B	August 4	126	25	151	16	

Number boxes cor demned	Per cent worms	Total pears per box	Wormy	Worm-free pears	Date	Shipper
	12	165	20	145	August 4	T
	12	155	29	126	August 4	\mathbf{T}
i	15	150	25	134	August 4	T
2	42	165	71	94	August 5	F
j	56	165	94	71	August 5	F
/	29	151	45	106	August 5	U
9	19	135	25 62	110	August 5	U
)	40	123	62	61	August 5	U
1	27	158	38	120	August 6	V
	29	180	53	127	August 6	Ÿ
	11	163	18	145	August 6	V
1	21	165	36	129	August 6	H
'	27	183	50	133	August 7	D
!	12	180	22	158	August 7	D
L į l	11	172	20	152	August 7	${f E}$
i	15	195	31	164	August 7	E E
)	40	160	65	95	August 8	W
	21	170	36	134	August 9	W X X O Y
	25	179	45	134	August 9	X
	46	163	75	88	August 9	0
انا	15	165	25	140	August 9	Ÿ
	33	153	51	102	August 10	\mathbf{z}
	42	112	48	64	August 10	\mathbf{z}
2,				1		

Come to the State Fruit Growers' Convention at Sacramento on November 21, 22 and 23, and learn what eastern fruit buyers have to say about standardization of the California fruit pack.

CROP REPORT AND STATISTICS.

MONTHLY CROP REPORT.

(September 1, 1917.)

By GEO. P. WELDON.

Compiled from reports of the county horticultural commissioners.

Counties	Almonds (per cent)	Apples (per cent)	Apricots (per cent)	Cherries (per cent)	Figs (per cent)	Grapefruit (per cent)	Lemons (per cent)	Olives (per cent)	(per cent)	(per cent)	(per cout)	Plums (per orat)	Prumes (per cent)	Walnuts (per cent)
Alameda	40	50	h	h						ь	h	þ	h	100
Butte		20	#	h	100	25		70	25	80	20	60	75	
Colusa ¹	60	-	h		100	#	-		-		100	100	110	100
Contra Costa ²	70	90	50	60		#	#	#		100	100	40	90	100
El Dorado	. #	70	#	. #	#	#		#	#	80	86	80	90	
Presno			h	#	90	#	90	100	40	90		#	*	
Glenn ^a	70	90	50	. #	#	I #	95	100	95	80	75	#	80	
Humboldt		80	h	h	#	#	#		#	90	90	_		
[mperial	#	#	-	#	i —	#	#		#		_	*	#	
In y o	#	65		, #			*	*	#	0	0			
Kern	#	100	þ	#					50	55	100	75	100	
Kings	#	#	, h		*	#				95			100	
Lake4	70	100	i #	#	#	#		#	#		100		100	
Los Angeles ⁵	50	70	45	j #	75	75	60	25	70	100	80	60		70
Madera		100	þ	#	100	#		65	#	120		h	90	
Marin		40	ı b	, b	#	. #	#			80	90		80	
Mendoeino		100	-	-	*	#		*	#		100	#	100	-
Merced		#	h	b	100	, #	#	100	*	100		#		
Modoc	ı #	95	50	50	#	#		#	#	45	75	100	100	
Monterey	60	75	80	, h	#	#	#		, #	90	90	70	60	
Napa		100	h	h	. #	#	#	#	#	100	b	h	110	
Nevada		80	0	h	40	. #	#		#	60	100	75	#	
Orange		90	, p	'#	#		80		80	100				70
Placer		70		, h	-	#		70	30	70	50	35		
Riverside		100	, b	h	#	45	30	25	16	85	75	#	100	80
Bacramento		100	85	h		. #	100	50	50	100	115	100	80	
San Benito		100	h	h	*	0	#		#	100	100	#	100	100
San Bernardino		95	b	b		75	10	35	20	100		#		75
San Diego		90	h	#		90	60	40	55	100	100	#		1
San Joaquin			þ	h	#			-	#	100	h	100	100	75
San Luis Obispo		60	80	#	#	#	#		#	56	40	#	75	65
Santa Barbara		100	100	100	#	100	75	50	85		100	#	#	100
Santa Clara		90	h	h	. #	#	#	#	#	80	65	#	72	
Santa Cruz	-	100	þ	h	#	#	75	#	#	80	90	-	95	
3hasta		60	b	h	. #	#	#	15	#	88	75	#	65	
Siskiyou		80	#	h	#		#	#	#	80	90	95	96	. #
Solanos		#	50	60	1 #	1 #	#	#	#	50	100	45	60	-
Bonoma		90	75	50	*	. #			#	90	90	75	70	70
Stanislaus		#	h	h	110	#	*	60	40	ь	þ	h	100	100
Butter	65	100	#	100	80	#	#	70	#	85	100	100	100	
Pehama		50	, p	h	50	#	#	40	25	70	50	h	75	
Fulare		#	h		100	75	80	65	65	95		95	105	
Ventura		#	90	h	*	_	10	-	15	*	_	#	_	75
ľolo	50	75	h	h	80	. #	#	65	75 #	60	75	h	85	80
Tuba	70	90	#		90			80		70	100	75		

Reports from Napa and Solano counties by Farm Advisers.

Figures indicate condition of crop in per cent on the basis of 100 as normal.

⁻Horticultural commissioner has insufficient information for a report.

Not grown commercially.

^{1.4} Report for month of August. h—Harvested.

Estimated Per Cent of the Normal Fruit Crop Grown in Each of the Main Producing Counties.

Compiled from reports of the county horticultural commissioners, 1915.

Countles	Almonds (per cent	Apples (per cent)	Apricota (per cent)	Cherries (per cent)	Figs (per cent)	Lemons (per cent)	Olives (per cent)	Oranges (per cent)	Peaches (per cent)	Pean (per cent)	Plums (per cent)	Prunes (per cent)	Walnute (per cent)
Alameda	•		. 14	9					•	2	•		
Butte	12	•		•	8		14	•	8	2	•	2	
Colusa	4		•	#		. *	# :	. #	•	•		•	
Contra Costa	11	•	•	•	#		# 1		•	6	•	•	
El Dorado	#	•		•			# 1		•	8	•	•	
Fresno		#	5	. #	58	•	8	•	29	. #		•	
Glenn	•	•	•	. #		•	•	•	. •		#	•	
Humboldt	#		#	•	#	*	#		•	•		•	
[mperial		#	÷	#			#				ž		
Inyo	#	•	. #		#	*			•	و ا			
Kern	#	•		#	#		#	•	•	•	•	•	
Kings	<u> </u>		5	#	#	#	#		6	#		•	•
Lake	•		#		#				•	8		•	
Los Angeles	2	2	4		•	31	14	26	4	į ě'	8		30
Madera	•	•	•	#	8		2		•		į		
Marin		•	•						•	•	•	•	
Mendocino	#	•	*		#					•			
Merced	•		•		9		•		8				
Modoc		-	#			· #					ē		
Monterey	•	12	2		#	, <u>.</u>				1 -	-	•	
Napa	•	•	•	•	#		*	ě		4 .	•	4	
Nevada		8	•	•	<u>"</u>			-	•		•		
Orange	#	•	4			7		10	•		2		38
Placer	÷	•		8	•		•	•	6	7	80		
Riverside	8		7	•		16	11	14	•	•		÷	
Sacramento	6	•	•	5	1 1	•	5	•	•	18	8	•	
San Benito	•		6	•	1		#	#	. •			8	
San Bernardino	*	4	. 4	•				81	5		- 1		2
San Diego	ž	· •	•		<u>.</u>	10	5	•	i .	; ;	- 2	· •	
San Joaquin	12		. 8	25			4		. 8	4			•
San Luis Obispo.						-		-					
Santa Barbara	#		•	2	7		2			. #	•		16
Santa Clara	*	•	21	26						∖ 🧖 ا	18	. 55	1 2
Santa Cruz		51	3	2	-		#	, i	;		1.0	~	
Shasta	÷	•	ž	ž	- F			, i		•			
Siskiyou	#						•						
Solano	6		8	10	7	7	- 7	7	8	6	16		:
Sonoma	#	16	•	. 9	7	ä	5	;		6		12	:
Stanislaus	6	. #	•		5		ž	:	8			12	
Sutter	9			•	8		7		2	• '			
Tehama	•						11	:	:	2	•		- :
Tulare	#	' #	•	<u>"</u>	6	5	6	13	9	_		4	:
Ventura	# .		6	ž	#	15	ž	2				:	' •
Yolo	11	#	5	<u>.</u>	5	#	3	ĩ	2	' 5 '	4	2	20
Yuba	•		#		2	, i	8 :		•			٠,	;
1 11VW			•	•		•	• 1	-				. •	. •

^{*}Less than 2 per cent of state's normal crop grown in county, \$Not grown commercially.

HYUF.



REPORT FOR THE MONTH OF JULY, 1917.

By FREDERICK MASKEW.

SAN FRANCISCO STATION.

Steamship and baggage inspection:	
Ships inspected	
Horticultural imports:	Parcels
Passed as free from pestsFunigated	127,888 3.063
Refused admittance	107
Contraband destroyed	33
Total parcels horticultural imports for the month	131,091
Pests Intercepted.	
From Central America:	

Aspidiotus cyanophylli, Chrysomphalus scutiformis and Pseudococcus sp. on bananas.

From China:

Larvæ of weevil in sweet potatoes. Lepidopterous larvæ in dried herbs. Weevil and lepidopterous larvæ in dried potatoes. Weevil in roots.

From Hawaii:

Diaspis bromeliæ and Pseudococcus bromeliæ on pineapples. Coccus longuius on betel leaves.
Larvæ of Trypetid in mangoes and string beans.
Weevil in seed pods.

From Japan:

Coccid on pot plant.

From Mexico:

Larvæ of weevil in beans.

From New York:

Diaspis boisduvalii on orchids.

From South Sea Islands:

Pseudococcus sp. on palms.

From Tahiti:

Coccid on oranges.

LOS ANGELES STATION.

LOS ANGELES STATION.	
Steamship and baggage inspection: Ships inspected	
Horticultural imports:	
Passed as free from pests	Parcels 134,291
Funigated	353
Refused admittance	•
Contraband destroyed	12
Total parcels horticultural imports for the month	134,662
Pests Intercepted.	
From Central America: Aspidiotus cydonis and Aspidiotus cydnophylli on bananas.	
From Connecticut: Pseudococcus sp. on ornamental plants.	
From Mexico:	
Calandra sp. in corn. Unidentified lepidopterous larvæ in dried bananas.	_
From New Jersey:	-
Hemichionaspis aspidistræ on sago palm. Diaspis boisduvalli on orchids. Gymnaspis æchmeæ on Vriesia speciosa. Aspidiotus cyanophylli on Anasas sativus. Pseudococcus sp. on Medinilla magnifica and dracenas.	
Eucalymnatus tessellatus on palm. From New York:	
Saissetia olea on Cycads.	
From Pennsylvania: Saissetia hemisphærica on gardenias.	
SAN DIEGO STATION.	
Steamship and baggage inspection:	
Ships inspected 15	
Fish boats inspected18	
Passengers arriving from fruit fly ports86	
Horticultural imports:	
Passed as free from pests	Parcels 2.519
Fumigated	G
Refused admittance	0
Contraband destroyed	4
Total parcels horticultural imports for the month	2,523
EUREKA STATION.	••
Steamship and baggage inspection:	
Ships inspected	
•	
Horticultural Imports:	Parcelle
Passed as free from pests	2

SANTA BARBARA STATION.

(No report.)

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GOLDEN ANNIVERSARY FIFTIETH CALIFORNIA FRUIT GROWERS' CONVENTION

SACRAMENTO

November 21, 22, 23, 1917

under the ampices of the

COMMISSION OF HORTICULTURE STATE OF CALIFORNIA

ANGLES OF LANGLES OF L

UNIVERSITY OF CALIFORNIA COLLEGE OF AGRICULTURE BERKELEY

UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

THOMAS FORSYTH HUNT, DEAMAND DIRECTOR
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UNIVERSITY FARM SCHOOL

CIRCULAR No. 174 SEPTEMBER, 1917

FARM DRAINAGE METHODS'

By WALTER W. WEIR,

Senior Drainage Engineer, U. S. Department of Agriculture

This circular is intended for use only in sections of the state which are free from alkali; it is not applicable to irrigated land.

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¹ This circular was prepared under a co-operative agreement between the Office of Public Roads and Rural Engineering, U. S. Department of Agriculture, and the University of California, Agricultural Experiment Station.

INTRODUCTION

The purposes of this circular are to call attention to the need for drainage on many of the California farms which are located in regions where the annual rainfall is sufficient for agricultural purposes; to outline the advantages to be derived from drainage; to recommend the use of tile and the systematic construction of open drains; to offer suggestions regarding the spacing, depth, and size of drains, as well as methods and cost of installing them; and to urge better cooperation between the owners of adjoining farms in the disposal of storm water and surface run-off.

THE NEED FOR DRAINAGE

The average annual rainfall in the state varies from more than fifty inches in portions of Del Norte, Humboldt, and Mendocino counties and the northern high Sierras to less than ten inches over most of Imperial, San Bernardino, Riverside, and Inyo counties and the San Joaquin Valley. Most of the Sacramento Valley and the coast region south of San Francisco receive an annual rainfall of from ten to twenty inches. Figure 1 shows the distribution of the rain over the state. A very large proportion of the total annual rainfall occurs during December, January, February, and March.

The sections which receive twenty inches or more of rainfall have a tendency to become too wet for proper cultivation during certain periods. Generally the heavier soils which do not absorb water rapidly and which are most in need of drainage are found on the flatter valley floors or in depressions. Almost every farm has some place where the water stands too long after a rain, causing a partial or total failure of erop. Other places remain too wet for plowing and can not be seeded when the rest of the field is ready. These spots must be plowed and seeded later or be left uncropped. In either case, there will be an added expense or a material loss in crops. The saving of this expense may not seem important during any one year, but when the damage is continually recurring it assumes considerable significance.

EFFECTS OF DRAINAGE

In addition to the obvious benefits obtained by removing excess water and reclaiming swampy areas so that they may be profitably cultivated, drainage has other marked effects upon the soil. Some of the most important benefits thus derived are as follows:

Drainage improves the granulation or tilth of the soil. This is accomplished through the removal of the excess water quickly after

OBJECTIONS TO OPEN DRAINS

Open drains are objectionable in that when they are deep enough to thoroughly drain the land they are of such width as to become an inconvenience in the field. Ditches are much more expensive to maintain than are covered drains. The unavoidable roughness of the sides and bottom of a ditch causes sediment to be deposited and drainage is thereby impaired. Weeds and brush collect in ditches and must be removed frequently if drainage is to be maintained. If the fall of an open drain is too great the water causes the banks to erode and cave.

Open drains waste not only the land which they occupy, but the land along their banks which they prevent from being cultivated. Even a comparatively small ditch, with its waste banks, may easily render uncultivable a strip of land fifty feet wide. Such a drain requires over six acres for each mile in length, whereas this land is saved to cultivation where covered drains are used. Weeds which grow upon the ditch banks are unsightly and difficult to eradicate; they harbor undesirable insects and animals, as well as plant diseases. Open drains necessitate bridges for crossing, and they cut fields into irregular shapes, making cultivation mor difficult. The presence of ditches in small fields make it impractical to use certain heavy farm Except in that they more readily take care of surface water, open ditches are not as efficient as underdrains; the sides are more likely to become puddled and the lateral movement of the ground water retarded.

IMPORTANCE OF ENGINEERING ASSISTANCE

A drain should not be constructed without first obtaining levels over the line and establishing a definite grade, bottom width, and side slopes. If this is not done there will be difficulty in maintaining uniformity in grade and the drain may become congested at points where irregularities occur. The importance of reliable engineering assistance in designing and constructing large ditches is seldom questioned, but many small farm drains are dug without any engineering This practice should be discouraged, especially assistance whatever. if the farmer himself is not familiar with the fundamental principles of stream flow and the use of the engineer's level. A careful engineer will make a survey, not only of the surface to determine the fall, alignment, etc., but he will make frequent borings into the soil to determine the subsoil conditions. California soils and subsoils are often quite variable within short distances. A knowledge of subsoil conditions frequently is a great aid in determining such important matters as depth, spacing, and shape of drains.

Figure 2 illustrates the various types of drainage systems. One would hardly expect to find complete drainage by open ditches following the "gridiron" or "herringbone" systems in which the drains follow a regular system of parallel lines with definite spacing between. Such a system would so interfere with cultivation as to make it impracticable. Probably the greater part of our land to be drained by open ditches, except as the latter are used for outlets, would require the natural or irregular system which follows the natural depressions in the surface and seeks only to remove water from the low places or to divert or collect storm waters.

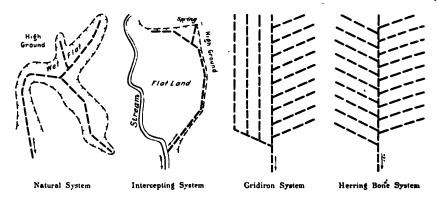


Fig. 2.—Illustrating arrangements of drains.

OUTLETS

The outlet is the first consideration in drainage. When the outlet is to be in a stream, creek, or natural watercourse, one must determine whether the outlet is adequate; that is, whether at times when drainage is most essential it is capable of carrying the added water from the drain, and whether the outlet is deep enough to insure proper drainage to the fields which it is proposed to drain. Outlets are sometimes used when it is known that for short periods after a storm they will be overtaxed. Such a condition is not desirable but often it can not well be overcome. If the outlet is to be a ditch on another man's property, one should obtain the right to use it either by purchase or otherwise. When it is not possible to obtain a gravity outlet, pumping is sometimes resorted to and the water disposed of through channels whose elevation is higher than the drainage depth.

In rolling land, an outlet is usually easy to obtain, but on the flatter lands one should not attempt to determine the sufficiency of an outlet "by eye," and the use of an engineer's instrument is necessary. An outlet to be satisfactory must have the drain discharge freely into it.

DESIGN OF OPEN DRAINS

For areas up to 160 acres, drains in the humid sections of California should be designed to remove about one surface inch² from the tract in twenty-four hours. If water reaches the tract from other sources, the entire contributing area should be considered rather than merely the area it is proposed to drain. For larger areas the run-off may be decreased to three-fourths inch in twenty-four hours. Conditions of tilth, topography, and soil are determining factors in the rapidity and amount of run-off. In a field in good tilth and of gentle slopes the soil will retain much more water than in barren fields or in those having greater slopes. The size of ditch required to carry a given amount of water is dependent upon the slope or grade and, to a less extent, upon the shape of its cross-section; the shape is determined with reference to the kind of soil through which the ditch passes.

An open drain should be both deep and wide enough to carry the maximum flow without overtopping its banks, and to carry the normal flow well below the general ground surface. The banks of the ditch should be sloped to such an extent as to prevent, as far as possible, any caving when they are wet. In clay the side slopes may be as steep as one-half foot horizontal to one foot vertical, while in sandy soils it may be necessary to make the slopes as flat as two feet horizontal to one foot vertical. The excavated material should be placed some distance from the edge in order to prevent it from slipping back into the drain. A safe rule to follow for ditches under twenty feet in top width is to place excavated material so that the berm, or distance from the edge of the ditch to the toe of the waste bank, is equal to one-half the top width of the ditch. The ditch shown in figure 3 has sloping banks, and a wide berm is left between the ditch and the waste bank. All of the excavated material is in this case placed on one side of the ditch.

Rather shallow surface ditches can be dug satisfactorily with teams where the ground is firm enough to permit teams going upon it. Team and scraper ditches are sometimes used where surface water accumu-

^{2&#}x27;'Inch'' as used in this paper means 1/12 of a foot and must not be confused with the term "miner's inch," frequently used in California by mining and irrigation interests.

lates in considerable quantities and the drain is required simply to remove it quickly. Drains of this nature are expected to be dry most of the time and are so dug as to be of least hindrance to cultivation and cropping. In many cases cultivation is continued over such drains.

Open drains dug by hand are necessarily limited to rather small ditches, seldom over three or four feet wide on top and four or five feet deep. Ditches of this type are of much less inconvenience when located along fence or property lines than when located through a field.



Fig. 3.—Construction of an open drain by machinery, Marin County, Cal.

Drains to which stock have access should have slopes so flat that they can be entered without damage to the drain or injury to the stock. Figure 4 shows a type of hand-dug open drain suitable for a heavy soil.

The banks of open drains, at the points where surface water enters, must be protected so as to prevent erosion which not only destroys the banks and wastes land, but also fills up the drain and impairs its efficiency. Surface water may be admitted to an open drain through a box or culvert under the waste bank. When properly constructed, such a box will be a protection to the ditch bank against washing.

METHODS OF CONSTRUCTION

Open drains for the farm are constructed in three ways: by machinery, with teams and scrapers, and by hand. There are several types of excavating machinery for digging open drains; these vary in size from the large floating dredge capable of excavating drains up to 100 or more feet in width, to the excavator which will dig a drain three or four feet in width. For farm drains, however, only the smaller types of excavators are used and these only by the larger farms or by several farms adjoining in a general plan of drainage. Figure 3 shows an open drain being constructed with power machinery, in Marin County, California. When drains are constructed during the dry season, teams may be used. Ditches excavated in this way are necessarily limited to rather shallow, broad drains

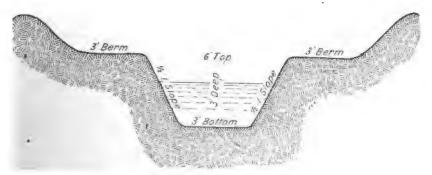


Fig. 4.—Type of hand-dug ditch suitable for heavy soils.

in soils stable enough to permit the driving of teams over them. Under certain conditions and for certain types of drain, this method is both cheap and efficient. Digging drains by hand is feasible only when they are small enough to allow the excavated material to be disposed of without rehandling.

MAINTENANCE

Open ditches require a considerable expenditure for maintenance. It is this item that makes the final cost of open drains equal to or above that of underdrains. In order to maintain the efficiency of a ditch, it is necessary to clean it at least once each year. Brush and weeds that are certain to grow during the dry season must be removed, caving banks must be repaired, and all obstructions such as temporary fences, rubbish, etc., removed before the wet season begins. After a year or two it may be necessary to deepen the drain in order to

maintain the desired depth. If these things are not done it will not be long before conditions will become as bad as they were before the ditch was constructed. The cost of maintenance of course varies with the amount of excavation and repair work necessary; in a few years it may amount to a considerable proportion of the first cost.

UNDERDRAINS

Underdrains represent the ideal method of reclaiming wet or swamp areas. They may consist of tile or of wooden box-drains, and are covered with soil so that they do not interfere with cultivation. There is little danger of properly constructed tile drains becoming obstructed, and consequently they require little or no maintenance. Tile drains are permanent, and although the initial expense may be in excess of that for open drains they are, in the end, cheaper and better.

The two general systems of drainage heretofore described—the regular and the natural—apply to underdrains and each system is capable of greater variation when tile are used. Figure 2 shows some of the variations possible. Unless the slopes are quite uniform, combinations of the various systems are often used.

DESIGN OF UNDERDRAINS

Use of Soil Auger:

The soil auger is one of the tools most frequently used by the careful drainage engineer. Figure 5 shows a soil auger of the type commonly employed. This auger consists of a 1½-inch carpenter's auger welded to a ¼-inch rod which by the insertion of additional sections can be extended to six feet or more. The point of the auger should be filed away so as to make a straight cutting edge and the points of the worm should be bent downward to facilitate cutting into very hard soil. Subsoil conditions, as for instance the presence or absence of hardpan, gravel, or clay strata, have a marked bearing on the location, depth, and spacing of drains. Borings with a soil auger will quickly determine the true subsoil conditions.

The drainage of land which is wet from springs often requires a great deal of care in the selection of the proper locations for the drains. It is essential that the exact locations of the springs be determined so that the drains shall intercept the water before it has spread through the surrounding soil. When a considerable area has become saturated by springs it may be difficult to determine their exact locations, but the matter is of sufficient importance to justify considerable effort to locate them accurately. The depth, spacing

(if more than one is required), and size of drain required for springy land must be determined for each individual case and the information is often most easily obtained by a diligent use of the soil auger.

Grade:

Other things being equal, the more fall that can be obtained for a tile line, the better and more rapid will be the drainage. A fall of one foot per thousand feet is about as little as it is advisable to use, although many successful tile drains have The greater the fall, the greater will be the carrying capacity of the drain or the smaller the drain required to carry a given quantity of water. Too much emphasis can not be laid on the necessity for accurately determining by means of engineering instruments, the available fall, the grade upon which the drain is to be laid, and the sufficiency of the outlet, Figure 6 shows tile on grade lines which have been correctly and incorrectly determined. Wherever it is possible to do so, the grade should be made steeper as the outlet is approached. Such a condition is a reasonable assurance that the drains will not become clogged by particles of soil settling in the tile lines.

Depth:

The depth to which tile should be laid is variable. In sandy soils tile may be placed deeper than in clay soils, because in the former the water more freely penetrates the soil and consequently reaches the tile lines more readily. In heavy clay soils percolation is slow, and if drains are placed too deep the water may not reach the tile rapidly enough to make the drain efficient. Generally speaking, the greater the depth to which the soil can be completely drained, the more efficient the system will be. Sandy

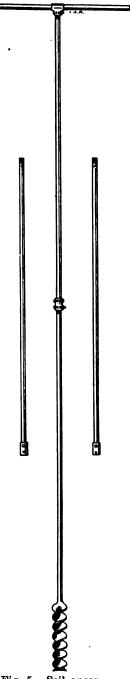


Fig. 5.—Soil auger.

or sandy-loam soils usually require drains placed about four to six feet deep, while in clay loams and clay, drains placed three to three and a half feet deep may prove more efficient. Experiments indicate that about three feet should be the minimum depth for tile, even in clay soils.

Spacing:

The proper spacing of drains depends to a considerable extent upon the depth. The lateral movement of water in the soil is retarded by the fineness of the soil particles, in the same way that the downward movement is retarded. Consequently, drains may be spaced farther apart in sandy soils than in clay. The deeper the drains, the farther apart the lines may be placed. Figure 7 illustrates the relation of spacing to depth. In soils ranging from sand to sandy loam, drain lines may be placed from 150 to 300 feet apart; while in heavy silts and clays, it may be necessary to place the lines as close together as thirty or forty feet. It is not possible to give specific rules for

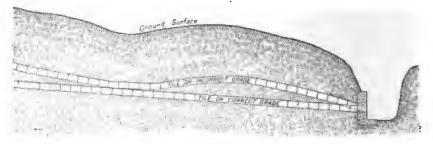


Fig. 6.—Correct and incorrect grading for tile.

either the depth of tile or the spacing between lines, even for similar types of soil. Conditions may be such that one line of tile will be sufficient to drain a heavy soil while several lines will be required to drain a sandy loam. The intercepting system illustrated in figure 2 is an example of a single line of tile reclaiming a considerable area. Every drainage problem calls for the exercise of good judgment rather than the use of set rules. A knowledge of both surface and subsoil conditions is even of more importance in designing tile drains than in designing open drains. For example, a soil which is apparently a clay on the surface may be quite sandy at three or four feet below, or the reverse may be the case. A knowledge of these conditions is essential to the proper design of a drainage system.

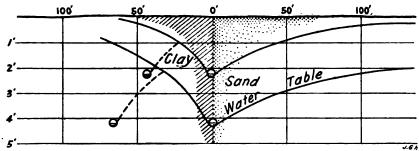
Table I shows the number of feet of tile required per acre when spaced the given distances apart. To these figures would have to be added whatever mains are necessary to afford an outlet.

TABLE I
TILE REQUIRED TO DRAIN AN ACRE OF LAND

Spacing, feet	Tile required per acre, feet	Spacing, feet	Tile required per acre, feet
30	1452	150	291
40	1089	200	218
50	872	300	146
75	581	400	109
100	436		

Size of Tile:

The proper size of tile to use is one of those details for which it is difficult to give definite directions because of the many influencing factors. Farmers' Bulletin No. 187, U. S. Department of Agriculture, gives the following summary of the conditions which determine the size of drains, particularly the mains.



- Fig. 7.—The relation of spacing to depth.
- (1) What depth of water per acre will it be necessary to remove from the land in a given time, say twenty-four hours, in order to secure the desired condition of the soil?
 - (2) How rapidly will the water be brought to the main drains?
- (3) What surface drainage does the tract have that will be available for carrying unusual rains?
- (4) What is the nature of the soil as regards its drainage properties, that is, is it open or retentive?
 - (5) What are the grades upon which the tile must be laid?

The amount of rainfall over the state varies, as previously stated, from more than fifty inches to less than ten inches. Drainage, however, has to deal with the extremes of rainfall rather than with the yearly totals. Rather heavy rains during certain parts of the year will cause very little run-off as the water is nearly all absorbed by the soil. On the other hand, a rather moderate rainfall following a period of wet weather, during which the soil has become saturated,

may almost entirely run off. Under extreme conditions, in which the collecting or lateral system of drains is adequate and the soil open, mains may well be designed to carry a run-off of one inch in depth from the tract in twenty-four hours. Under ordinary conditions, mains capable of carrying in twenty-four hours a run-off of one-half inch in depth of water from the entire tract will be found adequate.

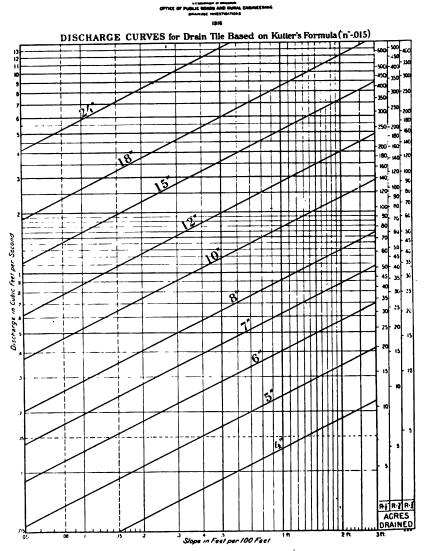


Fig. 8.—Curves showing capacities of drain tile at various slopes, and acres drained at different rates of run-off.

When computing run-off, the area contributing water to the badly-drained tract should be considered rather than the area actually to be drained.

It is never advisable to use tile smaller than four inches in diameter, even for short laterals; in fact, some tile factories have discontinued the making of drain tile less than four inches in diameter. Even with the greatest care irregularities in the grade or laying of the tile are sure to occur. A slight irregularity in a line of small tile has a much more serious effect on its efficiency than does a similar irregularity in a line of larger tile.

Four- and six-inch tile (preferably six-inch) may ordinarily be used for lateral drains 1500 feet or less in length. Six- and eightinch tile may be used for submains and the upper ends of mains. Some factories make the intermediate sizes, five- and seven-inch, which can of course be used in their proper places. From the diagram in figure 8 the carrying capacities of tile on different grades can be determined. The diagram also shows the number of acres drained at different rates of run-off.

Where a complete system is installed it is not necessary to make the capacity of the main drain equal to the combined capacities of the laterals. Lateral drains are seldom required to carry their full capacity; in fact, a drain that runs full for a considerable time may safely be considered too small.

The difference between the cost of a drainage system using four-inch tile and of one using six-inch tile for laterals, lies almost entirely in the cost of the tile itself, which is seldom more than 30 or 35 per cent of the entire cost of the system. The smallest trench that it is practicable to dig by the methods usually employed in California will be large enough for six or even eight-inch tile. There is not enough difference in weight between a four-inch and a six-inch tile to add materially to the cost of laying, and the cost of backfilling will be the same in both cases. Furthermore, incidental expenses do not increase in direct proportion to the size of tile used. To be of the highest efficiency, the tile must be of sufficient size to remove all surplus water before the crops are injured, even after the heaviest rainfall in a continued wet period.

KINDS OF TILE

Two kinds of drain tile are available in the market, clay and cement. Clay drain tile are made in sizes varying from four inches to twenty-four or thirty inches in diameter. The usual practice is to increase the diameter for each succeeding size by two inches up to

a diameter of sixteen inches, and by four inches thereafter. Some factories, however, make tile five, seven, and fifteen inches in diameter. Clay tile up to and including twelve inches in diameter are usually made in one-foot lengths, and in two-foot lengths for the larger sizes.

The tile should be straight, well-burned, and free from cracks or The use of so-called "soft" or "porous" tile should From a practical standpoint tile are not porous, be discouraged. and a "soft" clay tile is merely the result of under-burning and should be looked upon as defective. It is sufficient to say, in this connection, that water enters a tile line through the spaces between the individual tile and not by passing through the walls of the tile It is not essential that tile be vitrified or "salt-glazed," although a vitrified condition is by no means undesirable. glazed, fully-vitrified sewer pipe is frequently used instead of the regular drain tile; in this case, however, the joints are left un-The use of sewer pipe is objectionable only in that it usually requires a little more time in laying, and the extra weight caused by the unnecessary "bell" adds somewhat to the freight costs. The cost of first-grade sewer pipe is usually prohibitive so far as drainage work is concerned, but "seconds" can often be purchased at prices comparable to those of drain tile. Sewer seconds should be rather closely inspected before being used, and inferior tile discarded.

Cement tile may still be considered to be in the experimental stage. Satisfactory cement tile under twelve inches in diameter can not be made as cheaply as can clay tile, but over that size the cost of the former is somewhat less. One part of Portland cement and two or three parts of clean sand, properly mixed and cured, make a satisfactory product. Cement tile made of the same constituents will vary considerably if made by different persons. The average tile user is better able to judge the quality of clay tile than he is of cement tile as they are found in the yard or at the local dealers. Home-made cement tile are usually of inferior quality unless experienced work-men are employed.

CONSTRUCTION OF TILE DRAINS

Laying out the Drain:

When laying out a drain, stakes one foot or more in length should be placed by the engineer at intervals of fifty or one hundred feet along the line and plainly marked with a station number indicating the distance from the outlet or beginning of that particular drain. Thus, stakes marked 1+00, 1+25, or 2+50, indicate that there are respectively 100, 125, or 250 feet of drain up to these points.

Close to each of these stakes the engineer should drive another, the top of which is flush with the ground surface, on which he takes his levels. It is from this latter stake, generally called the "grade stake," that he measures the "cut" or depth at that point. The grade stakes are so placed as to be reasonably safe and must not be disturbed by the digger. The depth of the trench at this point is either marked



Fig. 9.—Trench kept straight by means of cord.

on the guard stake or furnished the workmen, the latter method being preferable as the guard stakes are liable to be broken down and lost. Before commencing the excavation, the workmen should stretch a line about six inches to one side of the line of stakes as shown in figure 9; digging to this line will insure a clean, straight cut.

Ditching Tools and Machinery:

Although there are several hand implements for constructing tile drains, such as the short-handled tile spade and tile fork, grading

scoops of various sizes, and tile hooks, the only tools in common use in California are the pick and long-handled shovel. Figure 10 shows several tools which will probably become more common in California as drainage work develops. The grading scoop especially should be more generally used.

There are several types of machinery for use in excavating trenches for tile drains. These vary from the plow which costs less than \$20 and is suitable for loosening the surface foot of the trench, to the power-driven trenching machine, costing from \$1500 to \$6000, that will excavate a trench into which the tile can be placed without further

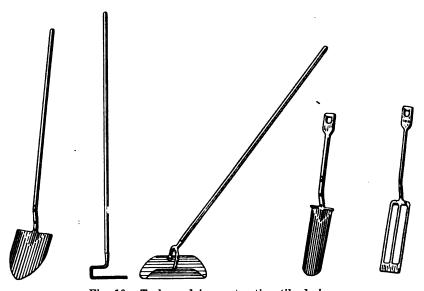


Fig. 10.—Tools used in constructing tile drains.

work. Figure 11 shows an excavator at work digging a trench for tile drains. The purchase of an expensive, power-driven machine is not advisable unless there are ten or fifteen miles of tile to be laid, or unless the machine can be rented to others who contemplate tile drainage. A good trenching machine must be able to operate in any soil that is free from rock; it must be capable of cutting true to grade, and it must be strongly and simply constructed. It is often possible to borrow trenching machinery that is temporarily idle, from a town where it has been used in sewer construction. One of the principal advantages of excavating with machinery is in having the work done quickly. Under favorable conditions it is not unusual for a trencher to dig one-quarter to one-half mile of four-foot trench per day. In

determining the cost of trenching by machinery, the items of operation, repairs, and depreciation should all be included.

Digging to Grade:

Digging to true grade is the important operation in excavating for a drain. Several methods are in use by which the bottom can be graded from the grade stakes set by the engineer. If the workmen are not familiar with one of these, the engineer should instruct them. A very simple method, and one which gives the true grade at all points along the line, is to stretch a light, stout cord on cross-bars directly over the trench, and say $5\frac{1}{2}$ feet above the proposed bottom. By measuring from this cord with a $5\frac{1}{2}$ -foot pole, the grade of the

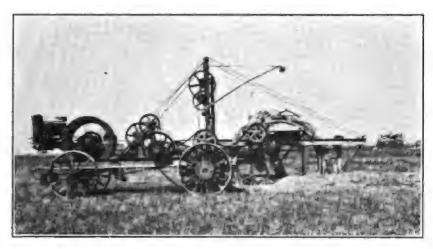


Fig. 11.—Drainage excavator digging trench for tile drain.

bottom at any point is easily determined. The line is placed just high enough to make the "cut" below the grade stake, plus the distance of the line above the grade stake, equal to $5\frac{1}{2}$ feet. Thus, if the cut at station 5+00 is given as 4.0 feet, and that at station 6+00 is given as 3.5 feet, the cross-bar must be 1.5 feet above the grade stake at station 5+00, and 2.0 feet above the grade stake at station 6+00. In placing the cross-bar which supports the cord, one stake supporting the cross-bar is driven down alongside the grade stake until the cross-bar is the required distance above the stake; then another stake is driven on the opposite side of the trench until a carpenter's level shows the cross-bar to be level. If the grade stakes are 100 feet apart it is well to support the cord at one or more points between so that there shall be no sag. This can be done quite accu-

rately by sighting along the cord. A measuring pole of other length than 5½ feet may be used, but the height of the cord above the grade stakes must then be changed accordingly. Figure 12 shows the method of securing the correct grade by means of an overhead cord. The cord should be retightened frequently as changes in temperature and moisture conditions cause it to sag, and it should always be retightened after having remained on the cross-bars over night.



Fig. 12.—Grading the trench by means of overhead cord.

Engineers usually furnish figures showing cuts and other measurements in feet and decimals of a foot, and not in inches. Workmen unfamiliar with this method of measuring should be furnished with measuring rods properly graduated; or, if this for any reason is not feasible, the engineer should change his figures to the form better understood by the layman. Table II gives the decimals of a foot converted to inches.

TABLE II
DECIMALS OF A FOOT TO INCHES

| Ft. In. |
|----------------------|----------------------|----------------------|----------------------|------------------------|
| | .20 = 2% | .40 = 4% | $.60 = 7\frac{1}{4}$ | .80 = 9% |
| .01 = 1/8 | $.21 = 2\frac{1}{2}$ | .41 = 4% | .61 = 7% | .81 = 9% |
| .02 == 1/4 | $.22 = 2\frac{5}{8}$ | .42 = 5 | $.62 = 7\frac{1}{2}$ | .82 = 9% |
| .03 = % | $.23 = 2\frac{8}{4}$ | $.43 = 5\frac{1}{8}$ | $.63 = 7\frac{1}{2}$ | .83 = 10 |
| $.04 = \frac{1}{2}$ | .24 = 2% | $.44 = 5\frac{1}{4}$ | .64 = 7% | $.84 = 10 \frac{1}{8}$ |
| .05 == 1% | .25 = 3 | .45 = 5% | .65 = 7% | $.85 = 10\frac{1}{4}$ |
| .06 == 3/4 | $.26 = 3\frac{1}{8}$ | $.46 = 5\frac{1}{2}$ | .66 = 7% | .86 = 10% |
| .07 = 1/8 | $.27 = 3\frac{1}{4}$ | .47 = 5% | .67 = 8 | $.87 = 10\frac{1}{2}$ |
| .08 = 1 | .28 = 3 % | .48 = 5% | $.68 = 8\frac{1}{8}$ | $.88 = 10\frac{1}{2}$ |
| $.09 = 1\frac{1}{8}$ | $.29 = 3\frac{1}{2}$ | .49 = 5% | $.69 = 8\frac{1}{4}$ | .89 = 10% |
| $.10 = 1\frac{1}{4}$ | .30 = 3% | .50 = 6 | .70 = 8% | .90 = 10% |
| .11 == 1% | .31 = 3 % | $.51 = 6\frac{1}{8}$ | $.71 = 8\frac{1}{2}$ | .91 = 10% |
| $.12 = 1\frac{1}{2}$ | .32 = 3% | $.52 = 6\frac{1}{4}$ | .72 = 8% | .92 = 11 |
| $.13 = 1\frac{1}{2}$ | .33 = 4 | .53 = 6% | .73 = 8% | .93 == 111/8 |
| .14 = 1% | $.34 = 4\frac{1}{8}$ | $.54 = 6\frac{1}{2}$ | .74 = 8% | $.94 = 11\frac{1}{4}$ |
| .15 = 1% | $.35 = 4\frac{1}{4}$ | .55 = 6% | .75 = 9 | .95 = 11% |
| .16 = 1% | .36 = 4% | .56 = 6% | $.76 = 9\frac{1}{8}$ | $.96 = 11\frac{1}{2}$ |
| .17 = 2 | $.37 = 4\frac{1}{2}$ | .57 = 6% | $.77 = 9\frac{1}{4}$ | .97 = 11% |
| $.18 = 2\frac{1}{8}$ | .38 = 4% | .58 = 7 | .78 = 9% | .98 = 11% |
| $.19 = 2\frac{1}{4}$ | .39 = 4% | $.59 = 7\frac{1}{8}$ | $.79 = 9\frac{1}{2}$ | .99 = 11% |
| | | | | |

Laying Tile:

The digging of the trench and the laying of the tile should always begin at the outlet and proceed toward the upper end. shows the tile so distributed in the field that it can be laid with the least handling. It is generally best to lay the tile as soon as the trench is ready in order to avoid possible damage to the trench by rains, caving banks, etc. If the bottom of the trench is known to be true to grade at every point, the smaller sizes of tile can be laid from the bank with a tile hook (see fig. 10); otherwise they are laid by a man who stands in the trench and places each tile after having made the bottom true to grade with a grading scoop or shovel. tiles are laid end to end as closely as they will lie in the trench. Tiles will often be found whose ends are not square, but by turning them slightly they can be made to fit quite closely. Figure 14 shows how tiles with such ends can sometimes be matched so as to make a good A tile with a small chip broken from the end but which is otherwise sound can be used by placing the broken side down or by carefully covering the break with a piece of broken tile or a flat stone. A tile that is cracked more than one-quarter of its length, or is broken on the end so that the break can not be properly covered, should be discarded. It should be remembered that a tile which fails after

being placed in the ground will completely destroy the usefulness of the entire line above it; it is obviously poor economy to endanger the efficiency of an entire line in order to save a joint of tile.

Just'as soon as a tile is in its proper place, a little earth should be cut from the side of the trench and placed about the tile so as to prevent it from rolling out of line. After 50 or 100 feet of tile are laid, and at the end of each day's work, the tile laid should be covered



Fig. 13.—Trench ready and tile properly distributed.

with earth to a depth of three or four inches so as to prevent possible dislocation or injury to the tile from stones or chunks of earth which might fall upon them. There need be no fear ordinarily that the tile will be laid so close together that the water can not enter. The former practice of covering the joints with straw or gravel to prevent the entrance of soil is now largely abandoned as being unnecessary and expensive. Well-laid tiles will be close enough together to prevent the entrance of any foreign matter and will yet admit water freely. The

use of rock or gravel in covering a tile line is not objectionable, but the use of brush or sticks should be discouraged.

Backfilling:

If the tile are to be inspected by the engineer such inspection should be done just before it is covered. The filling of the trench can be accomplished in several ways. In places where the work is crowded, such as in an orchard or around buildings, the backfilling can best be done by hand with shovels. In the open field the soil is usually plowed into the trench. A long doubletree is provided so that one horse or one team is on each side of the trench. This method requires from two to three men and steady teams. Small slip scrapers or four-horse "fresnos" are sometimes used, in which case the team works on the opposite side of the trench from the scraper.

All of the earth excavated from the trench should be replaced; otherwise there will be a depression along the line when the soil settles.

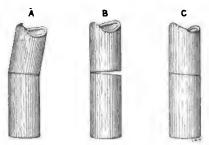


Fig. 14.—Tiles whose ends are not square may be rotated to make a good joint.

BOX DRAINS

Box drains may be used, when lumber can be secured at a reasonable price and tile is very expensive. The installation of box drains is similar in every respect to that of tile and the same care should be used. Redwood lumber is relatively durable for underground work and in California should be used in preference to pine or fir. It is reasonable to expect boxes to last for ten or twelve years; if kept wet during the entire year they will last much longer.

A simple form of box is shown in figure 15a. The lumber for the smaller boxes should run lengthwise, and where conditions will permit the sections may be from twelve to sixteen feet long. The top is nailed tightly to the sides, but the bottom is held away from the sides by short pieces of lath placed at intervals of three or four feet. In boxes where the interior dimensions are greater than eight inches square, two-inch lumber should be used and the top and bottom put on cross-

wise as shown in figure 15b. In large boxes for main drain, the lumber for the top, bottom, and sides should all run crosswise (figure 15c). The bottom pieces should be separated so that when the lumber becomes wet it will not swell and close all openings for the water. The use of box drains without bottoms is not advisable as the water is likely to undermine the sides and cause the box to settle. Furthermore, the roughness of the ground reduces the capacity of the drain.

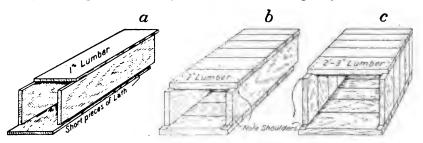


Fig. 15.—Types of lumber box drains.

SURFACE INLETS, SILT BOXES, AND OUTLETS

Surface water should not be allowed to enter directly into a tile line unless some provision is made to exclude sand, dirt, sticks, and other rubbish. Figures 16 and 17 show two methods of screening surface water before it enters a tile line. If there is a considerable quantity of water the stone filter, illustrated in figure 16, should extend over a greater length of tile than shown. The types of screen

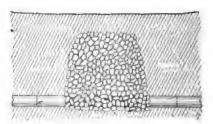


Fig. 16.—Buried stone filter for admitting surface water to a tile line.

shown in figure 17 admit water more readily to the tile line, but when located in open fields are somewhat of an obstruction to cultivation.

It is good practice to install silt boxes at intervals along a tile drain to catch and retain any silt that may enter the line. These boxes may be made of lumber, concrete, or brick. A very satisfactory lumber silt-box which combines also manhole and observation well is shown in figure 18. It is inadvisable to construct silt boxes so small that they can not be readily entered and cleaned. They should be

placed at points where the grade changes to a flatter one, or where there are abrupt changes in direction of the line. The junction of two lines is easily effected through such a box although in a "regular" system of drains it would not be advisable to place a box at each junction.

The outlet of a tile drainage system, unless very favorably located should be protected by some device which will prevent the tile from washing out or becoming injured or displaced. The outlet protection may be made of lumber, stone, brick, or concrete, the design depending upon the conditions which exist at the outlet. In any case care

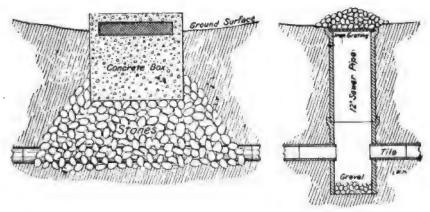


Fig. 17.—Surface inlets with screens.

should be taken to secure a good foundation and anchorage so that the structure will not be undermined. Figure 19 shows an outlet protection for small tile, and figure 20 illustrates one suitable for larger tile. Whatever construction material is used in making silt wells may also be used for outlet protections.

MAINTENANCE OF TILE DRAINS

Tile drains which are properly laid will require very little maintenance. The silt boxes should be inspected frequently during the first year and at regular intervals thereafter, and should be kept free from silt. The covers of silt boxes should be kept closed at all times; if necessary they should be locked so that they can not be opened by inquisitive persons. Tumble weeds, rabbits, and squirrels may enter the silt boxes and obstruct the tile lines unless this precaution is observed.

Soil will not seal the joints and prevent the entrance of water into the tile lines unless very unusual conditions prevail. There need be no fear of the roots of fruit trees growing into a tile line unless the tile carries water when the surrounding soil is dry. Such a condition would exist when the drain taps a spring which flows long after the surrounding area has become dry. Cottonwood and willow trees

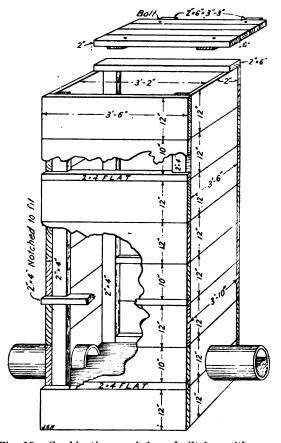


Fig. 18.—Combination manhole and silt box with cover.

should not be allowed to grow within fifty feet of a tile line as there is more danger from these water-loving trees than from fruit trees.

Should a tile line become obstructed in any way, silt boxes located at frequent intervals will aid materially in locating the obstruction. A number of devices have been developed for cleaning sewers which can be used for drain tile when necessary. These may also be found

useful during construction, especially if the tile is laid in a wet, muddy trench. The most common form of tile cleaner is one whose several sections can be joined together when the rods are held at right angles but can not be unhooked when extended. These rods may

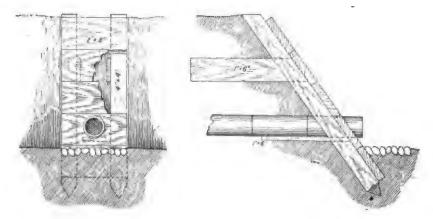


Fig. 19.—Timber outlet protection for small tile.

be used with or without any of the various attachments such as an auger, wire brush, hoe, or spiral cutter. A very simple brush can be made by wrapping a piece of leather belting around a cylindrical



Fig. 20.—Stone or brick outlet protection.

rod, the belting first having been driven full of wire nails of such a length that the completed brush will not quite fill the tile. Figure 21 shows a cleaning device of this type. Care must be exercised not to use anything that may become detached or which will catch on the tile. Two hundred and fifty feet or more of rod can be operated in a straight tile line.

COST OF TILE DRAINAGE

The ultimate question with regard to drainage work is, will it pay? In order to determine this one must know what it will cost. From what has been said regarding the varying sizes of tile, spacing and depth of drains, and the various structures required, it is evident that definite statements on the question of cost can be made only when the complete details for a particular project are at hand.

Tile are sold by the foot, with discounts from the list price on orders of 1000 feet or more, and further discounts for carload lots. Prices for tile are much higher in California and the other western states than in the east or middle west. There are probably less than a half-dozen factories on the Pacific Coast which manufacture clay drain-tile exclusively, most factories making drain-tile to order or as

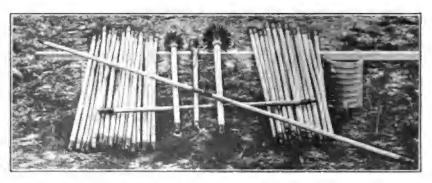


Fig. 21.—Sewer rods and tile cleaning devices.

a side line in the manufacture of other clay products. Table III contains quotations and weights per foot as furnished by one of the California factories which makes drain tile exclusively.

TABLE III COSTS AND WEIGHTS OF CLAY DRAIN TILE

Size in.	Cost per 1000 ft.*	Weight p	er ft.	Size in.	Cost per 1000 ft.*	Weight per ft. lbs.	
4	\$40	8	•	10	\$110	27	
5	50	10		12	160	40	
6	60	14		14	200	44	
8	80	21		16	250	55	

* F.o.b. factory in carload lots, minimum car 26,000 lbs.; 10 per cent discount for cash.

Factories which make drain tile to order or as a side-line quote higher prices, while at least one factory making drain tile exclusively quotes lower prices than those given. To the final cost of tile must be added the freight charges and the cost of hauling from the railroad to the field.

The excavation by hand of trenches for drain tile will cost from 5 to 10 cents per lineal foot for depths of three to five feet. The cost varies somewhat with the season, the soil, and the amount of labor available. Labor can usually be secured for this kind of work for 25 cents per hour. Laying and blinding will cost from one-quarter to one-half cents per lineal foot, and backfilling from one to two cents per linear foot.

The total cost of installing four-inch tile drains at a depth of $3\frac{1}{2}$ feet, when all the work is done by hand, may vary from 11 to 18 cents per linear foot. The use of six- and eight-inch tile does not materially increase the cost of excavation, laying, and backfilling. Machine-dug trenches should lower the cost of excavation to from one and one-half to four cents per linear foot, while experienced labor and the use of improved tiling tools may eventually make excavation by hand cheaper than the prices given above.

These statements regarding the cost of tile drainage should be used only as a general guide in making estimates. Short drains which follow the natural system may often be installed by the farmer without a great deal of expense beyond the cost of the tile and that of the labor which he usually hires. Extensive systems are generally installed by contractors who are equipped for and familiar with handling this kind of work. Contractors can usually continue work without interruption, whereas the farmer may find it necessary to temporarily discontinue the work at a critical point because of his other farm duties.

VERTICAL DRAINAGE

By vertical drainage is meant the passing of drainage water vertically through the soil into a porous bed of sand or gravel beneath; it is effected by means of wells or pipes extending into the porous substratum. Whether or not drainage can be accomplished in this way depends entirely upon local conditions and this method is by no means generally applicable.

Ideal conditions for vertical drainage would be presented by a surface soil which is kept wet by the accumulation of water above an impervious layer of clay or hardpan, beneath which is a layer of sand or gravel, the latter containing no water or permitting the water to escape readily. Conditions as these are very infrequent; on the contrary, the subsoil is more often filled with water which does not flow away. It would be useless to attempt vertical drainage where

there is no porous layer below, even though the subsoil were dry, as the capacity of the latter for water would be very limited and the drain would soon become inoperative. It would also be useless to attempt vertical drainage where the ground water is within a few feet of the surface during the time when surface drainage is most necessary.

Vertical drainage, where practicable, may be accomplished by boring an eight- or ten-inch hole well into the porous stratum and lining this hole with ordinary drain tiles set one on top of another. The top must be securely covered and screened so as to prevent the entrance of silt.or trash into the drain. Another method of accomplishing vertical drainage is to break up the impervious stratum with dynamite. This method is more applicable where the impervious layer is hardpan than where it is clay. The clay would have a tendency to soon puddle back into an impervious layer, and instead of breaking and shattering would pack and burn at the point of the explosion.⁸

Every instance of contemplated vertical drainage should be thoroughly examined, as more often than otherwise subsoil conditions will be found unsuited to this type of drainage.

CO-OPERATION IN DRAINAGE

It is seldom that a farmer can install an extended and comprehensive drainage system without co-operating to some extent with other landowners. Most frequently when co-operation is necessary it is in securing an outlet. The right to drain one's land should not be abridged by the prejudices of his neighbor, especially when there would be no injury to the neighbor; but the rights of those owning lower land which must be crossed by the drains of another must not be ignored, and if any injury whatever is sustained it should be paid for. As a matter of fact, it more frequently occurs that a drain benefits the lower land by crossing it, and some arrangement should therefore be made whereby the cost of such a drain is borne by both parties. So many questions are involved in such circumstances that it is impossible to arrive at any conclusions without a knowledge of all of the facts pertaining to the individual case. These matters, however, should be amicably settled before work is begun.

It is frequently desirable for three or four farms to join in one system of drains having a single outlet. Such a system may be installed as if the entire tract belonged to one man, and can be con-

³ Bulletin 209, Kansas State Agricultural College.

structed without reference to line fences. Agreements for co-operation may be either oral or written; in either case thorough co-operation is desirable. The cost of the completed system should be apportioned with respect to the relative acreage drained on the individual farms, rather than with regard to the costs of the drains on the different farms. C, whose farm lies higher than those of his neighbors, should help pay for the increased size of the outlet drain through A and B made necessary by C's drainage, while A and B are both benefited by the drainage of the tracts above them.

The adjustment of the cost of cooperative drainage is a delicate matter and the difficulties increase with the number of co-operative parties. Nevertheless, co-operative drainage should be encouraged as it usually results in more thorough and cheaper drainage for all concerned than would otherwise be possible.

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CIRCULAR No. 193 **MARCH**, 1918

A STUDY OF FARM LABOR IN CALIFORNIA

BY

R. L. ADAMS and T. R. KELLY



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Many agencies, ranging from the United States departments to the private employment bureaus, are trying to help the California farmer secure his labor supply. Thus far the sum total of the work has resulted in a somewhat better utilization of present supplies but has not greatly helped in adding to the total supply.

One good result of the past season is a growing realization that the farmers' labor problem also vitally concerns the State and that, if crop production is to be maintained, to say nothing of being increased, everyone must help-organized labor, the railroads, the general public, the military authorities, as well as the farmer and farm worker.

The burden of proving the need for labor rests with the farmer and the State, but a goodly share of meeting that need, once it is fully determined, rests with the entire country.

In presenting conditions, findings, and possible remedies in this report, it should be clearly understood that the office of State Farm Labor Agent, to represent the University of California College of Agriculture, the United States Department of Agriculture, and the State Council of Defense, was created solely to foster and assist in every way the labor supply, as it affects the production of food, feed, and fiber necessary to the conduct of the war.

Whether existing ranch conditions are good or bad for society or labor is not strictly pertinent to a war emergency office; nevertheless, while plans for greater production must utilize all resources, only changes should be advocated which will not tend to a dangerous aftermath upon the conclusion of the war.

DEFINITION OF FARM LABOR SHORTAGE

The term "farm labor shortage" is subject to several definitions. One definition considers a shortage as occurring only when actual crop losses are sustained from lack of labor. These losses may be in

acreage not actually planted, or in reduced quantity or quality of crops or animal products, directly traceable to labor insufficiency or inefficiency.

A second definition accepts a shortage as existing whenever labor is less efficient, commands increased wages, demands a shorter day, or is notoriously difficult to obtain.

It would seem unfortunate if we must reach a state of actual losses in production before shortage of labor is recognized, since in agriculture the time consumed in obtaining a remedy is of the utmost importance.

In this report a "farm labor shortage" is considered to be present whenever one or more of the following factors are being generally experienced by farmers throughout the state.

- (a) Losses in acreage, quantity, or quality, of normal production.
- (b) Inability to expand sufficiently to meet war demands for products, especially those specifically requested by the federal government.
- (c) Payment of higher than normal wages, either as cash or as perquisites.
 - (d) Importation of labor from outside sources.
 - (e) Difficulty in obtaining and holding men.

1917 EVIDENCES OF FARM LABOR SHORTAGE

In reviewing the large mass of data upon lessened production due to shortage of labor, several facts stands out. No state-wide losses in crops actually planted, nor serious reduction in amount of cropped acreages, has resulted because of labor shortages. Losses are scattered, local, and mostly individual, the sum total being surprisingly small.

The most serious losses have taken place in sugar beets, alfalfa, beans, certain fruits, and some vegetables. Of the more than two thousand farmers operating a total acreage of over 225,000 acres, as reported from farm center meetings, the losses in acreage are negligible. Losses in quantity are mose apparent than losses in acreage, and in some instances are quite marked. Losses in quality were not as outstanding as losses in quantity. Of the seventy-three firms operating over an acreage of more than 348,000 acres, one reports the loss of 25,000 tons of alfalfa hay, another estimates losses in cash as amounting to over \$200,000, and a third estimates losses at \$150,000. Vaca Valley estimates its fruit losses at \$62,500.

It would appear from the evidence that the small farmer got through the season with relatively less difficulty than the large operator. while generally the less favored sections suffered more than districts having advantage in the way of accessibility, climate, working conditions and living accommodations.

That exceptional weather conditions during spring plantings and fall harvests are responsible for minimum losses is generally conceded. Because of the unusual conditions the customary demand was lacking for help during the pinch of emergency necessity ordinarily occurring in normal years of showers during early fall months. Reduction in demand was also brought about by reduced yields in sugar beets, cotton, citrus and walnuts, while shortage of shook and shipping facilities curtailed labor needs in certain fruit lines.

From the standpoint of lower efficiency, higher wages, difficulty in securing men, and similar evidences of a labor shortage, 1917 offers abundant testimony of a farm labor shortage and suggests the urgency of immediate steps to improve existing conditions.

Labor has been less reliable and less efficient than usual during the past year. As a result farmers have had increasing difficulty not only in obtaining men but in holding them. Due to a general shortage in many industries other than farming, the best of the usual ranch help has been recruited for other lines, leaving the less efficient for the farmer's use. The military draft and volunteer service have drawn heavily upon the best class of farm labor, and while its effect has not been marked during the past year certain machinery men drawn to the army and navy have been difficult if not impossible of replacement. That the influence of the draft may be much more extensive next year is a reasonable deduction.

Estimates of 1917 efficiency compared with 1916, where reductions are noted, range in a drop from 10 per cent to 66% per cent, with a general average, as nearly as can be stated, of 25 per cent drop in efficiency. The small farmers complain less of reduced efficiency than do the large landowners.

Ease in obtaining work, high wages in other industries, and the saloon are the main causes, in the minds of those giving a reason, for reduced efficiency. The taking of the best men through the draft and presence of agitators are also mentioned.

The evidence proves conclusively that there has been a general advance in farm wages for 1917 over 1916, the increase ranging from 5 per cent to 100 per cent, or a general average advance of 40 per cent for both large and small operators reporting increases.

Along the lines of providing better living conditions there is a slight improvement to be noted. Apparently farmers do not consider

this much of a factor in obtaining and holding good men. Improvement in living conditions and hours of work have been mostly confined to the larger operators.

There has been a slight tendency toward substituting piecework for the hour and day basis. A few men report a decrease in the number of hours constituting a day.

To protect the sugar beet growers, actual importation into the State to the extent of 1700 men had to be undertaken, this past season, by various beet sugar companies.

To meet its harvest need Imperial Valley imported, by private subscription, several hundred Texas and Oklahoma families.

Summed up, the 1917 season presents evidence of a farm labor shortage to be found in:

- (a) Actual importation by private interests.
- (b) A wage scale 40 per cent generally higher than that of 1916 for migratory labor.
- (c) Inability to save the straw of the barley, wheat and rice fields.
- (d) Loss of men drawn to other industries.
- (e) A few instances of actual losses in crops and dairies.
- (f) Reduction of wood cutting for fuel.
- (g) Reduction of dairies.
- (h) Loss of men through operation of the draft.

The large employer has suffered more than the small operator. Since crop production has its greatest field for immediate expansion with the large employer, lack of sufficient help becomes serious.

Considerable apprehension is expressed with reference to desired extensions of the sugar beet acreages, long staple cotton plantings, and hemp fields—requested by the federal government—since all of these are special crops of relatively high man labor requirements.

EMERGENCY NEEDS VS. NORMAL NEEDS

In the above presentation no distinction as to crops is made. It is important to point out, however, that crops or animal losses may be either necessary to the conduct of the war or else of a truly non-essential nature. Beef, wheat, beans, sugar, cotton, hay and forage crops, wool, dairy and poultry products, certain fruits and some vegetables are war essentials. Watermelons, hops, asparagus, strawberries, cantaloupes, and similar crops are not classed as essentials.

Viewed in its war emergency aspect the labor situation assumes a much more serious look where shortage of labor to produce essentials

occurs than when non-essentials are concerned. Both groups must, however, be recognized and both assisted with labor, for if one or the other group is short of help it draws upon whatever supply is available, thus establishing a new equilibrium and spreading the shortage over all production. For this reason such an office as ours cannot afford to pass by any farm enterprise of magnitude reporting a real shortage of labor. Indeed, for this reason we are compelled to pay attention to all industries—mills, construction, manufacturing, mining, and transportation—which draw upon the same supply of labor as the farmer.

KIND OF HELP NEEDED BY FARMERS

California agriculture is highly specialized, each farmer usually confining himself to some one crop or product, as dairying, fruit, sugar beets, poultry, grain, or hay, and he, therefore, requires a type of labor able to do the particular kind of work necessary to successful production in his particular industry.

A dairyman wants men all the year who are able and willing to be on hand twice a day at twelve hour intervals, milk twenty to thirty cows, and, possibly clean out the milking sheds, and feed in the barns. An alfalfa hay producer wants husky men from about April 15 to November 1 who can handle teams in mowing and raking, lend a hand at cocking, hauling, and stacking, and irrigate between cuttings. grain grower requires men for a more or less definite period during the fall and rainy season to care for and drive eight or ten head of mules in plowing and harrowing. He then has an interval with no work until the hay or grain harvest starts—the last of May or the first of June. If harvesting is done by contract the grower's interest in labor ceases with the hauling off of the crop and its safe delivery to car or warehouse. The fruit grower needs additional help for any work he cannot do himself. On small acreages this means extra help only at harvest-to gather the fruit and prepare it for sale or for drying. The man operating extensive acreage of fruit does little more than supervise the work, and in addition to harvest hands needs men to prune, spray, cultivate, and irrigate. Even among the fruit men a difference exists in the kinds of labor which can be used. For picking up prunes or walnuts any labor can be utilized and so school children, Indians, and whole families of unskilled and inexperienced people are found to be satisfactory. For picking pears, or apples, or peaches, to be prepared for shipment, only experienced, skilled help is profitable. Spraying can be done with any good worker, but pruning demands men who understand the principles involved. Irrigating demands men who know how to apply water properly; it cannot be done to advantage by inexperienced hands. The poultry man wants help that understands poultry feeding, sanitation, breeding, and preparation of poultry products for marketing. This work consists of much detail and requires a man who not only can do the work but is quiet and gentle with the fowls. The sugar beet grower requires men able to do the hard, monotonous, back-breaking work of thinning the growing plants, and pulling and topping the mature crop to prepare it for shipment.

All this shows what a great variety of men is needed upon our ranches. California agriculture as it stands today represents the cosmopolitan effort of representatives of many nations, so many in fact that to list them would include almost all that have experienced much emigration—China, France, Germany, India, Italy, Japan, Mexico, Portugal, Russia, Sweden, and on around the globe.

Classes of Labor.—Three general classes of labor may be recognized upon California ranches, each occupying a special sphere.

First—Experienced unskilled men needed for the hard, tedious, back-breaking work which Americans cannot generally be obtained to do under prevailing wages and other conditions; e.g., asparagus cutting, onion work, sugar beet thinning and topping, hoeing beans, digging potatoes, and cotton and cantaloupe picking. Japanese, Mexicans, Filipinos, Porto Ricans, Chinese, and Hindus are mostly used with varying degrees of success for these operations.

Second—Experienced skilled men able to do ranch work without special direction, such as milking, handling teams, running machinery (i.e., mowers, binders, harvesters, tractors, engines), range riding, heavy work like bucking sacks and stacking hay, and special work as pruning and spraying trees, building fences, and picking certain fruits requiring judgment.

Third—Unskilled inexperienced people suited to some of the more simple operations such as picking up prunes and walnuts, hoeing weeds, cultivating growing crops, and picking certain fruits requiring little or no judgment.

Transient Labor Needed.—In the foregoing paragraphs reference is made to certain peculiar seasonal labor needs of California agriculture. Some of these typical labor seasons are shown more clearly in the following table:

Industry	Locality	Greatest period of needs	
Grain planting	Central California	DecJan.	
Grain harvest	Central California	June 15 to Aug. 15	
Cutting asparagus	Stockton delta	May 15 to July 1	
Cantaloupe harvest	Imperial Valley	May and June	
Sugar beet thinning	Southern California	Feb. and March	
Sugar beet harvest	Southern California	Aug. and Sept.	
Sugar beet thinning	Northern California	March and April	
Sugar beet harvest	Northern California	September	
Cotton chopping	Imperial Valley	Мау	
Cotton picking	Imperial Valley	Nov. and Dec.	
Egyptian corn harvestSan Joaquin and Sacramento ValleysSeptember			
	San Joaquin and Sacramento		
Pruning fruit trees	(deciduous)	Jan. and Feb.	
	ps (deciduous)		

To meet "peak loads," economic conditions have developed a well recognized floating population, mobile enough to move from section to section as crop demands require. Whether the presence of these people is good or bad, socially, is not for this report to discuss; the emergency pressure for food, feed, and fiber means that existing conditions must be met as they are.

The following table shows something of the variable need. This need cannot be accurately predicted in advance, because no one can foretell the influence of drought, rain, or hot or cold weather, advancing or retarding the period available for harvest.

Industry	Acreage	Number men required	Length of season in normal year, for given field
Hops (Sonoma County)	100	200-300	3-4 weeks
Asparagus	100	20-30	6-8 weeks
Sugar beet thinning	100	20-30	2-3 weeks
Sugar beet harvest	100	10-20	3-4 weeks
Picking up prunes (3 pickings)	100	7-10	4-6 weeks
Picking pears	100	30-100	2-3 weeks
Picking raisins	100	8-20	3-4 weeks
Cutting Egyptian corn	100	7–12	2-4 weeks
Picking cotton	100	10–15	2-3 months
Digging potatoes	100	6–35	3-8 weeks

The Present Greatest Need.—Of the various classes of help required to produce California's crops the greatest need is for a body of experienced laborers able to do hard, manual, unskilled work under prevailing working conditions. This is the kind of labor now in demand by railroads and other industrial enterprises. To supply this serious lack means that California under conditions of today, needs a class of labor which can take care of itself with the housing facilities that farmers may reasonably be expected to provide, labor that will be

available when wanted and able to withdraw to other industries or to take care of itself when not needed in ranch work. The investigations point against entieing white labor from other states for this work.

Another factor in the farm labor situation is the difference in attractiveness of different sections. The delta lands of the San Joaquin and Sacramento rivers are very dusty when dry, and white men will only do manual labor there as a last resort. Even if living accommodations were ideal, which in many cases they are not, the working conditions are such that white men will work there only as teamsters, tractor drivers, or machinery men. The July and August heat of the Imperial Valley is so great that a white man cannot do a full day's work there. It should be added, however, that from November to March, inclusive, the reverse generally holds true, and floating labor tends to gravitate toward the valley for these months. In the wheat fields, at the head of the San Joaquin Valley during harvest, and in the alfalfa fields, and at scraper work throughout the San Joaquin and Sacramento valleys, transient labor finds this work very trying during July and August and will not consider it unless badly pressed for money. This limits the amount of labor available for these districts; and when a shortage occurs in any part of the agricultural field, the drain of such labor as can be used from these sections begins as soon as the wage scale is adjusted elsewhere to offset higher wages paid in the less attractive communities.

It must be borne in mind that even within a given group all men are not equally capable. A great variation exists among Mexicans and Hindus, some variation among Japanese, and the greatest among the floating white labor. In fact, among the latter are many who may correctly be classed as "unemployables"-mentally defective and wrecked physically. Many of these men are literally incapable of doing a reasonable day's work on any farm. It is these that largely make up the crowds hanging around poolrooms, saloons, and employment agencies, at least during times when help is scarce, as has been the case during the last season. This condition often leads to the belief that there is plenty of help. Experience in such instances has frequently proved, however, that only a small percentage of the men care to consider a farm job, many of them hanging around for something calling for two or three hours and paying 50 cents or \$1.00, and that only a fraction of those who will consider farm work can be used to any advantage.

It is the growing conviction of the authors that the American farms are conducted best when labor-saving machinery is applied to

a variety of work. Hand labor does not appeal to a nation of strongly marked mechanical genius, and the monotony of often repeated routine operations does not commend itself to Americans. California has much of this kind of work, which is difficult of accomplishment without constant replenishment of the labor supply from sources which produce men able to do it. Obviously, therefore, one of the future methods of meeting the labor needs is a greater use of animal or gasoline power.

Work such as picking up prunes or walnuts, hoeing weeds, or picking berries and hops, is so simple that it can be done by school children or inexperienced city dwellers. The total work of this character is relatively small, hence no insurmountable difficulty is experienced in getting enough help to do it if the business is so organized that a reasonable daily wage is possible and suitable living conditions are provided.

FARM LABOR FOR 1918

To obtain farm labor for the coming 1918 season every effort should first be made to utilize to the best advantage all available home supplies. This may mean more attention on the part of farmers to the essentials of wages, housing, food, hours, and supervision. Or it may require the closing of the saloon, anti-vagrancy laws, or some similar course of action.

The completion of cantonment, the curtailment of highway construction, the possibility of a dry year, replacement of crops of high labor requirements for those of low demands, and shutting down of development work, will each have its influence on the labor supply. Even at that, it is evident that the farmer must have additional help of a kind able and willing to do the work required.

Much can be done to relieve the shortage if immediate action is taken to render the present supply more available or efficient. If, however, through failure to take such action or if, no matter how carefully manipulated, the supply bids fair to be insufficient, then additions must be made through importation from outside sources sufficient to insure the need of all farmers.

Farmers' Recommendations.—From a score or more of different recommendations made by farmers to relieve, or at least assist, the labor situation during the 1918 season, the following half dozen are preëminently foremost and are given in order of greatest insistence:

Import labor, most suggestions being in favor (1st) of Chinese or Orientals, (2nd) Mexicans.

Close saloons—a close second to importation of labor.

Practice more liberal exemptions of farm labor from military draft.

Develop potential supplies of home labor, i.e., children, women. city dwellers.

Bring about better distribution and utilization of present labor supplies.

Promote anti-vagrancy laws.

Conscript labor.

The Farmer's Responsibility.—During the past season there has been much discussion of the five fundamental requirements of farm laborers, i.e., wages, housing, food, hours, and supervision. Statements have been repeatedly made that if farmers would pay living wages or provide decent living or proper board they would have no trouble in getting men. There are grounds for complaint concerning treatment of men, but a sweeping statement is a misstatement of fact. That there is room for a clearer sense of individual responsibility on the part of the farmer towards labor, is apparently offset by the need for a feeling of responsibility towards his work on the part of the laborer.

Wages.—Farmers have been obliged to advance their wage scales in most instances to meet those in force in other industries which draw upon the same reservoir of labor. Our investigations tend fully to defend the farmer against any unqualified criticism that he does not pay wages commensurate with the demands of the labor market. Actual comparison of wages for definite months of 1917 over comparable periods of 1916 indicate a wage advance of close to 40 per cent.

Since farm work and farm living appears to be unable to compete with other industries using types of labor in common, it is suggested that the farmer may find himself obliged to reorganize his business so that even higher wages can be offered to draw men to ranch work.

Hours.—Our investigations point to the fact that the average ranch day—ten hours—is neither too short nor too long for the variety and kind of field work to be done on the ranch. No evidence of research has been unearthed to show what is the ideal length of day for the greatest efficiency, but with the kind of labor available accustomed to a given pace it is concluded that no suggestion need be offered looking to a change in the average present ranch day. While general practice indicates the ten hour day as a limit, it cannot be so absolutely since the very nature of the work, together with seasonal

changes which necessitate a great rush during certain periods (e.g., premature maturing of fruit due to continued spells of hot weather), will not permit rigid regulations.

If there are plenty of men in the fruit business it is possible for them to put in a ten hour day, and if they are few in number long hours must be the rule to insure getting in as large a proportion of the crop as possible.

Housing.—Investigations by two inspectors kept constantly at work for the Commission of Immigration and Housing, and independent inquiry on our part show that in many cases the housing of farm hands is inadequate. This inadequacy is well known to all those acquainted with western ranch life and is vigorously commented upon at Farm Bureau and other meetings of California farmers.

It should be recognized, however, that it is not always possible for the small employer to keep pace with the large employer in providing proper quarters. Fluctuating need of men, combined with the short period when bunk and cook houses are in use on many farms, explain why satisfactory living conditions, readily provided where labor is employed a large part of the year, are not feasible when a large army of help is needed for but a few days. Yet an improvement under these circumstances has been proved possible through the coöperative maintenance of a central camp by several neighboring farmers.

Difficulty in holding men not used to the ordinary living conditions on the average California ranch will be partly overcome by a recognition of the practical and pressing necessity of providing proper living conditions. Quarters provided for peon, coolie, or Oriental labor are generally not suitable for men demanding American standards of living. This fact is especially worthy of attention in the present scarcity of labor, should it become necessary and advisable to utilize men from cities or towns who, used to sanitary conveniences, some privacy, and reasonable facilities for recreation during hours off duty, will not submit to herding in common quarters.

The present housing and sanitary conditions are the result in many instances of the kind of labor to be housed. Migratory labor has in the past been careless and even downright unappreciative of attempts to provide more livable surroundings. Yet, if a better class of labor is to be attracted to many districts, more attention to good housing is imperative. A farmer must exert himself to differentiate between classes of labor and provide conditions which will attract and hold the class wanted.

It should be borne in mind, though, that improvement of quarters does not to any extent augment the available supply of labor. It merely aids the individual making the improvement in obtaining and holding help in competition with other employers similarly situated. Neither will it entirely eliminate the trouble of holding men under difficult conditions of dust, heat, isolation, or unattractive work.

Better housing does not, as a rule, necessitate extensive or expensive alterations. Satisfactory structures can be erected for a very reasonable sum, and this expenditure is usually well worth while, especially with help ready to respond to good accommodations.

Board.—Probably second only to the wage question is the laborer's interest in the variety, quality, and quantity of food. A higher than normal wage scale with poor food is less insurance against labor shortage than a normal wage scale with good board. The construction and lumber camps are apparently, in general, providing better board than are many farmers. The cost of boarding men in 1917 increased from 33½ to 100 per cent over costs of 1916. This constitutes an actual increase in the wage scale.

Supervision.—More attention to the selection of foremen properly qualified to handle men is worth considering on some ranches. Where the farmer does his own superintending of the men, in some cases, a study of the proper means to employ will lessen the difficulty of keeping men. This is a hard matter to define, but the investigations have shown enough examples of lack of ability or tact to warrant at least a hint along this line.

Selecting Crops of Low Labor Requirements.—An important possibility in connection with the better utilization of available help is the selection of annual crops of relatively low labor requirements, such as wheat, barley, non-sacharine sorghums in place of such crops as cantaloupes, tomatoes, peas, and sweet potatoes, wherever soil, climate, water, market, finance, and farming ability will permit.

The Liquor Question.—There is a marked and growing resentment on the part of farmers against the saloon. To them the saloon means periodical debauches, restlessness, reduced efficiency, curtailment of the working period, and incitement to crime. That the state-wide elimination of the saloon in its present way of doing business would increase the efficiency and availability of farm hands in general is, in the farmer's opinion quite incontestable.

The recent decision of Los Angeles to dispense with her saloons on March 31, 1918, and of Fresno and San Jose to become dry offer some opportunity to prove whether the labor supply of their vicinities will become more available or more efficient. Other communities will soon

be watching these important centers with keen interest from this point of view. As a general thing only a state-wide movement appeals to farmers, as many believe that dry districts are at a disadvantage.

It may be added in this connection, that use of light wines or beers does not fall under condemnation by the majority of farmers, the strong drinks—whisky. rum, gin, brandy—being the real offenders. It has been contended, however, that the saloon as a place of conviviality would have the same bad effect upon its habitues even if restricted to the lighter drinks.

An inquiry into whether or not anything could be added to the diet of the men to offset the stimulation of liquor resulted in conflicting opinions. Certain authorities believe that the plentiful use of sugars, lemon juice, peppermint, possibly fats, and similar foods would offset the desire for alcohol. Others contend that nothing will take the place of alcohol, that it is not taken for food or to supply any real or fancied need, but is drunk solely for the "kick" it contains. Men holding the latter view see no remedy in a changed dietary.

Something can be done by the farmers themselves in seeing to it (1st) that the men are properly nourished with wholesome food, properly prepared and in reasonable variety, and (2nd) that some attention is paid to the comfort of the men when off duty. We have received altogether too many complaints from workers that no reading matter was obtainable, that if available no decent light was provided, that quarters did not permit even reasonable privacy. It is not necessary to go into details. Each man knows just how far the quarters and facilities he provides will go to offset the desire for the relaxation and sociability now provided by poolrooms, saloons, and cheap boarding houses.

Conscription of Labor.—No farmer can afford to trust valuable stock or the future of his crops to labor whose interest is subject to no greater influence than conscription. The results with conscripted labor may be well compared with the unsuccessful results obtained with labor sentenced to farm work, examples of which occurred in California during the past season.

Conscripted labor will presumably not be trained or experienced, and the amount of work that unskilled labor can do is fairly well taken care of now.

Farmers point out that while soldiers may be satisfactorily conscripted, farmers must be raised. Farmers are considered a result of long development, soldiers of rapid training.

Conscription of labor is not to be confused with anti-loafing laws.

Anti-Loafing or Vagrancy Laws.—It is not probable that any great difficulty would be encountered in obtaining legislation along the lines of that accomplished by Maryland, West Virginia, and Wisconsin.

Before advocating actual passing of anti-loafing laws it would be well to see what happens to Maryland and Wisconsin during the slack winter season. The eastern types of agriculture are radically different from those of California. This may mean that with the periods of demand and the kind of help secured, the operation of these laws under eastern conditions may not be entirely directly applicable to California.

There seems to be serious question as to the constitutionality of anti-loafing laws. The moral effect of such legislation amounts to a good deal, however.

Vagrancy laws are generally now on local statute books, but vary in scope and execution. In the opinion of many, proper standardization and uniform enforcement of these existing statutes will go far to meet any need of anti-vagrancy legislation.

Recruiting Labor from Closing Work.—To insure better utilization of available labor and to assist in eliminating lost motion between employer and employee, communities should stand ready to send a man into sections about to discharge large amounts of labor, actually to recruit hands for the next need. For instance, Imperial Valley stood ready and willing to take over the hundreds of grape pickers released at the end of the Fresno raisin harvest this year, but due to lack of organization failed to obtain them before they had scattered. It seems worth while to see what can be done, using every available facility, to hold such labor together, provide as cheap transportation as possible, and deflect it to other communities whenever work in one section is completed.

Mobilizing Boys and Women.—Mobilization of boys from 16 to 21 into a Working Reserve will probably be tried out next year. Given a few weeks' training, handled in groups under proper leadership, and used for the kind of work they can do, these units offer possibilities. The plan is at least well worth a fair and thorough trial.

Following the same general plan as the Boys' Working Reserve, arrangements are being perfected to mobilize women for such work as they can do. The preliminary organization work is being handled by Mrs. Sidney Joseph of Berkeley for the Industrial Welfare Commission of California.

That considerable labor can be obtained through the efforts of school authorities, Y. M. C. A.'s, Boy Scout Masters, and certain

religious, charitable and social organizations, has been proved by the results of the past year. Taken all together, this labor is not to be ignored, with the caution, of course, that the work it can do represents but a minor part of the total work needed in California crop production.

To those inclined to under-rate this labor, we refer to the numerous camps put out by the Y. M. C. A., Boy Scouts, and high schools—many of whom did most excellent work—and to the fact that within two weeks of the closing of school a supply of over 2000 boys reported to us as available, was entirely absorbed just before school closed.

Closing of Schools.—If farmers will indicate the period of greatest labor need in their particular communities something can be done to close schools to provide emergency labor. During the past season, cooperation between school authorities and farmers for delaying the opening of schools has been quickly, easily and satisfactorily accomplished, indicating the possibility of more extensive use of this source of labor if farmers will press their claims.

Use of State Institutions.—To help relieve the shortage of milkers it is recommended that state institutions, particularly the prisons where dairy herds are maintained, bend every effort to break in men to be capable milkers. This could apply particularly to men subject to parole, taking into account the character of the offense for which they were committed as possibly making them undesirable for farmers' use.

This work might also be extended to include help for poultry yards, hogs, truck garden plants, and other farm activities represented at the institutions.

Training by Commercial Firms and Agricultural Schools.—Due to shortage of milkers, more can be done by those having facilities for training men in the proper handling of milking machines, such as agricultural schools and commercial firms, to turn out as many well equipped men for handling these outfits as men are available for training.

Better Distribution of Labor.—The past season has clearly demonstrated the need of better mobilization of unemployed labor and speedier distribution to points of need. Success has been obtained in several states with state conducted employment offices to register men and jobs and to clear between different sections. Attempts by this office during the past season to bring about better utilization of available help through the efforts of nineteen Farm Advisors and several additional County Farm Labor Agents appointed by the County Councils of Defense to bring employer and employee together within each

respective county proved the feasibility of this plan, but also indicated the need of a larger and freer organization, because, already overworked, superimposing of duties in connection with labor matters meant more than the Farm Advisors could successfully accomplish.

The logical method consists in extending or reorganizing the scope of the present Public Employment Bureaus of California so that they may undertake comprehensive plans to deal properly with this aspect of the case. Experience elsewhere indicates that California already possesses the basis of organization which if sufficiently expanded, equipped, and organized, will be able to do effective work. Temporary offices in localities of special periodical needs can form a part of the plan and be considered in any proposed reorganization.

SOME EXPERIENCES OF THE PAST YEAR

In a review of the work of this office there are several matters which may be of interest, not only as a record of past events but as bearing upon utilization of present help during future seasons; such, for instance, as the use of high school boys, advertising for help, degree of benefit derived from supplying of better housing, and the effect of the military draft.

Advertising for Help.—There are several instances from the experience of the past season which indicate the possibility of getting considerable help from local sources when farmers combine for concentrated action to meet their labor needs. Fresno's ability to draw to her section enough labor to handle her fruit crops, the test made of Los Angeles by the California Fruit Growers' Association, Santa Rosa's efforts to obtain hop pickers, Blythe's campaign for cotton pickers, Sebastopol's advertising for berry pickers, Ukiah's call for people for their bean cannery, and the results of efforts of an Oakland women's club organization to secure cannery help, provide good evidences of what can be done.

However, if people are to be continually drawn in this way, they must be assured either of a "profitable vacation" or else an adequate working wage, together with proper living conditions. Drawing people to a locality before work is available or failure to provide a decent environment will react against a community as much as attempts to get people into work not capable of paying a living wage.

Exemption from the Military Draft.—The replacement of drafted men, if replacement is at all possible, must be a matter of time, and certainly presents a condition which cannot be remedied for the 1918 crops. Replacement is difficult because men for ranch work require not only a good physique but a proper mental attitude toward the work—items requiring time and experience to develop, especially if city-bred material is used.

The effect of the military draft was not seriously felt in 1917, on account of its late occurrence, although a few instances are reported of damage sustained because of its operation. Considerable apprehension is expressed as to its effect on the coming season.

The biggest sufferers are the large employers, especially those using skilled labor—farm mechanics, tractormen, implement tenders, harvest crews, and hay baling crews—and the family operated farm whose main reliance is placed upon members of draft age.

The feeling is strongly presented that the best men are the ones taken, leaving only the less fit and the less competent.

IMPORTATION OF LABOR

Japanese and Hindus.—Such evidences as we have been able to gather lead to the belief that existing prosperous conditions in Japan and the present policy of the Indian government put these countries beyond reach as sources of farm labor.

Mexico, Hawaiian Islands, Philippine Islands and Porto Rico.— Investigations into Mexican, Hawaiian, Porto Rican and Philippine Island labor conditions indicate that both the Hawaiian and Philippine Islands are closed to us as having any extensive possibilities. For all practical purposes they may be ignored.

This leaves Mexico and Porto Rico of this group as the only alternatives, with special emphasis on Mexico as the logical source for California.

The present ruling covering importation of Mexicans from the United States Department of Labor, Office of the Secretary, order of May 23rd, 1917, permits importation of Mexicans with suspension of clauses covering head tax, literacy tests and contract of labor. Mexicans must furnish two unmounted photographs, and fill out identification card, original to be retained by laborer, and duplicate to be filed in the United States Immigration files.

Mexicans brought in under present suspension of rules must remain in agricultural work, or be arrested and deported.

Chances of Getting Mexicans.—Correspondence is now being conducted with the Mexican Government through their San Francisco Consul to obtain information of available Mexican labor supplies and

ways and means of obtaining them. While the outcome cannot be predicted with absolute certainty, it now appears that a large number of Mexicans can be obtained and under reasonable arrangements so far as the Mexican authorities are concerned.

Chances of Getting Porto Ricans.—California's experience with Porto Ricans indicates that they can be fairly profitably employed in many kinds of manual labor. They are not valuable with horses or around stock, but for hand work the few we have in the state have mostly proved themselves reasonably capable help.

While there is some danger of their becoming public charges, if work enough can be assured of a nature such as they can do, Porto Ricans are worth some consideration. Just how far California will care to go in tapping this source remains to be seen. The U. S. Department of Agriculture is authority for the statement that a large supply of labor can be obtained from there and that the War Department can be counted upon to furnish transportation to New Orleans. As these people are not subject to immigration laws and may move freely from their country to any point in the United States, some of the obstacles attached to other labor are removed. On the other hand, care in selecting workers must be exercised, as there is a blending of negro, Spanish and Indian blood among these people, certain strains of which make for a better class of workers than do other strains. Moreover, considerable time, three or four months, must elapse before they can be landed.

Porto Rico is not a hopeful source of supply, but it is worthy of trial.

Chinese.—To bring about importation of Chinese involves the procuring of transportation, assurances that the imported men will be returned at the expiration of a prescribed time limit, overcoming of difficulties as to the unconstitutionality of bringing in labor under peonage conditions, revising certain treaties, and winning the support of present opponents, as for instance, officials of organized labor and of the public welfare.

Among farmers who are acquainted with the capacity of Chinese to do the kind of farm work most in need of relief, there is a remarkable unanimity of opinion as to the desirableness of this class of labor. If the conditions outlined above could be satisfactorily met so that Chinese are obtainable, there is little doubt that they would prove a valuable factor in crop production.

Chances of Getting Chinese.—That almost any number of Chinese can be obtained, if the way is made clear for their admission, is apparently the consensus of opinion from well-informed sources. Details are given in Part II and there is no need for repetition here.

Other Sources of Supply.—Other sources of labor have been investigated and one or two are still under discussion, but for immediate practical results Mexico is apparently the logical source at the present time.

Importation of Labor by Railroads.—Before national immigration laws, effective last spring, practically closed Mexico as a source of labor supply, the importation of Mexicans for railroad construction work had a material effect upon the farmers' labor supply. Picking men up along the border and bringing them to southern California, the effect of the railroads' work was materially to raise the level of the labor reservoir. From the railroad camps the men would be drawn to the ranches, whenever press of work made their employment desirable. By tolerating loss of men in this way, the railroads occupied a very important place in providing labor, recognizing that the "borrowing" of these men by the farmers would mean an increased freight business for the railroads themselves.

One of the easiest ways to begin to relieve the farm labor shortage necessitates nothing more than a return to the conditions which will permit the railroads to import all the Mexicans they can use by removing, during the period of the war, all restrictions upon importation of Mexicans or their employment by railroads, and to encourage resumption of importation on an extensive scale at the earliest opportunity.

It is particularly important that importation of labor be in charge of some organization able to meef all needs, since anyone who attempts to import labor will soon find he must bring in enough to supply the needs of all sections. One section draws upon the labor supply of a neighboring section, a practice which if continued long enough, means that the importer continues to furnish labor at the source to pass through the various ramifications of labor needs until an equilibrium is established.

Labor Under Prescribed Restrictions.—While the simplest way is the way just outlined above, i.e., to restore conditions by which the railways reassume the burden of bringing in laborers, it is well to point out that opposition to this plan may have to be met, and it therefore seems wise to have an alternate plan in case the preceding method does not prove workable.

In importing Mexicans the past season, under agreement with the United States Department of Labor, the six sugar beet companies of southern California were held morally responsible for the proper care of the laborers and their return to Mexico at the expiration of the time limits allowed. Since it is possible that importation of labor can be

obtained only under some similar method, the following plan is offered as a working basis to insure quick action and sure results as soon as the need for labor can be foretold with reasonable accuracy.

When labor is to be brought in under controlled conditions, charge of the men should be vested in a state or federal official, as for instance, the superintendent of either the Public Employment Bureaus of the State of California or the Federal Employment Service of the United States Department of Labor. All imported labor should be registered with the superintendent and be checked up from time to time by a representative of his office. Responsibility for seeing that imported men stay with the work then rests with the state and not with the individual farmer. This is enlarged upon somewhat a few paragraphs below.

In planning for importation of labor it is only fair to insist that those needing this help take the responsibility, both morally and legally, of assuring employment to the imported men. With definite promises of work it will be possible to determine actual needs and then to bring in only enough men to meet these needs.

In most cases, because of the short periodical needs for men in the specialized industries, with which California agriculture is mostly concerned, cooperation will be necessary between different sections and perhaps between different industries. This means that if the Delta farmers can use and will agree to use so many men for so long, then the raisin industry or the sugar beet industry or cotton picking can perhaps be relied upon to take these men at other periods, thus insuring them reasonably steady employment. For periods when agriculture does not need the men attempts should be made to get the lumber and wood camps, and railroad or road maintenance and construction to take care of them.

Housing conditions should be provided in accordance with regulations of the State Commission of Immigration and Housing, proper consideration being given to the climatic conditions of the locality and the degree of responsiveness of this labor to decent surroundings.

Since the wage scale and hours of work are usually subjects of contention, a wage schedule equivalent to the prevailing wage for unskilled labor must be a part of any programme in importing labor. To determine what these schedules shall be can perhaps best be handled by a committee clothed with authority to act. This committee should be representative of the different interests involved. It should include representation from the farmers, the workers, to be represented by consuls or labor union officials, the state (i.e., Commission of Immigration and Housing, State Council of Defense, Bureau of Statistics,

United States Department of Labor), and the business interests (i.e., railroads, bankers, lumbermen, manufacturers based on agriculture, such as sugar mills). This committee should be required to meet at stated intervals, and, from statistics of present supply and demand for labor, set the price to be paid for the ensuing definite period. In considering what is a fair wage scale the board should bear in mind that the usual newly imported classes of labor are unable to deliver a full day's work until some time after their arrival. A graduated scale may therefore be necessary in making up wage schedules. In southern California, for instance, Mexicans in railroad work receive about fifty cents a day less than other ordinary labor, because it is found that the incoming labor is so much less capable that the average daily output is reduced to this extent.

The board may also be empowered to pass upon farmers' requests for labor. On receipt of a definite request to consider importation of labor under controlled conditions the board should be required to review, with any body of farmers, all details and with them to formulate a basis for procedure. The board would endeavor to find additional work for the people to be imported, to insure reasonably steady employment; and to attempt to secure railroad co-operation in connection with the cost of importation.

Obviously importation of labor under the foregoing plan is of first importance only to the large employer of labor or to farmers operating concertedly. But if these men and organizations can be supplied in a wholesale way, relief for the employer of but a few men will be forthcoming automatically.

Cost of Importation.—The experiences of 1917 indicate that the actual expenses of bringing in labor runs to a high figure, even when the source of supply is as close as Mexico. For this reason the railroads should be considered a partner in any importation work, with the special function of undertaking, so far as is fair and reasonable to them, the collection and importation of the desired laborers.

Government Importation.—So many difficulties beset the work of private importation that once the need of outside labor is definitely determined, importation of it under federal jurisdiction is almost a practical necessity, even under prescribed restrictions, except it be done by the railroads as already indicated. If, for example, 20,000 men are needed to insure California crop production, the responsibility for getting the men may rightly be vested in federal authority. This authority would provide concentration camps, guarantee wages, assure reasonably steady employment, assign the jobs, set the wage scale,

determine the size of units to be sent out, provide group foremen and interpreters, supply transportation from place to place as crop needs demand, be responsible for proper housing, protect the farmer from unfair desertions, and keep constant track of all the men involved. Farmers or others wanting this labor would deal directly with this governmental agency, not with the men themselves.

It is believed, moreover, that these suggestions can be carried out without any taint of peonage or other character repugnant to our laws and customs. Non-fulfilment of contract should merely mean deportation to the laborer's own borders.

Employee's Point of View.—Considerable evidence has been collected to throw light upon the employee's point of view. From the material gathered thus far it appears that there are cases where labor has been mistreated, ranging in degree all the way from light mistreatment to that of the grossest sort.

Sooner or later everyone who delves into the farm labor problem finds himself face to face with the question: "What is the underlying cause of the present unrest among the men?" Evidences that unrest is generally prevalent can be noted on every hand. The need of solving the problem is important for several reasons. Granted that these discontented ones are "marginal men," there are altogether too many of them for the good of the community. In other words, their problem is one in which society must interest itself. With present lack of men every means must be taken to remove the cause of the restlessness and thereby enhance efficiency. The liquor curse, the pool hangouts, the quick shift from job to job, are only symptoms. Is this unrest due to half-education, to earlier sorrow, to a craving for adventure, to a loss of ideals, to a feeling that capital is arraigned against labor, to sensitiveness continually touched by neglect, until, the individual loses his grip, to a lack of an outlook, of an ideal, or too much prosperity?

Both farmer and worker will be the gainer when the reason or reasons are made clear, assuming that there is a common answer. Enlightenment should come from the men themselves—not from the employers.

Upon the answer to this question depends whether or not better housing, food, hours, wages, etc., are of primary or only of secondary importance. It is possible that when the real cause or causes of unrest are discovered, these items will assume such a small place that they may be ignored as not a general panacea for present labor shortages.

'PART II

STUDIES IN DETAIL

In April, 1917, the office of State Farm Labor Agent was created to direct the farm labor activities of the University of California, College of Agriculture and of the Committee on Resources and Food Supplies of the State Council of Defense. June 1st, the United States Department of Agriculture vested its work in this state in the same office, thus making the efforts of one man and his associates responsible for the three interests.

Personnel.—S. B. Freeborn of the College of Agriculture faculty, was obliged, after three months' service, to sever his connections with the office.

Beginning August 20th, Professor M. B. Pratt of the University of California has been able to give one-half his time, chiefly in the field, to the work of the office.

A. J. Nielsen spent three months during the summer, as student assistant, closing investigational work.

Organization.—From time to time other members of the University of California College of Agriculture staff have been assigned to assist in the work, and some student labor has also been utilized. On an average two of the staff have been kept constantly occupied, and one student about half of the time. These, with a stenographer, have constituted the working force of the central office.

To handle local labor matters directly, arrangements were early completed for the appointment, by each County Council of Defense, of a County Farm Labor Agent; this agent to be the Farm Adviser in every county having such an officer. Many agencies have assisted in the work of this office, among which the California Commission on Immigration and Housing and the California Public Employment Bureaus deserve special mention.

The state office, with respect to county needs, acted primarily as a clearing house. This plan, furthermore, called upon County Farm Labor Agents to appoint such district agents as seemed necessary, whose requirements should be met by the County Agent. These were the lines proposed by the United States Department of Agriculture for organizing the state comprehensively in order to meet, if possible, all emergencies arising from farm labor needs.

Briefly summed up, the duties of the local farm labor agents and County Farm Labor Agents were indicated to be as follows:

(A) LOCAL AGENTS:

- 1st-To act as a labor bureau for his territory.
- 2d—To be within telephone call at certain specified hours each day, e.g., 12 to 1 and 6 to 7 P.M.
- 3d—Keep a list of all applications for work (as per form No. 1 shown in pamphlet, "The Farm Labor Situation in California").
- 4th—Keep a list of all requests for farm help (as per form No. 2, shown in pamphlet, "The Farm Labor Situation in California").

- 5th—Endeavor to supply the farmers from his available lists, and by canvassing so far as he is able the local supply for additional help.
- 6th—If unable to supply local needs directly the local agent is to report to the County Agent for workers.
- 7th—Render a weekly report to the County Farm Labor Agent on form No. 3.

(B) COUNTY AGENTS:

- 1st-To act as a labor bureau for his county.
- 2d—To be within telephone call at certain specified hours each day, e.g., 8 to 12 and 2 to 5 P.M.
- 3d—Keep a list of all applications for work coming to his office directly (using form No. 1, shown in pamphlet, "The Farm Labor Situation in California").
- 4th—Keep a list of all requests for farm help (using form No. 2, shown in pamphlet, "The Farm Labor Situation in California").
- 5th—Endeavor to supply the farmers from his available lists, and by canvassing so far as he is able the local supply for additional help.
- 6th—To make every attempt to utilize elsewhere in the county surplus supply of labor reported by the local farm labor agents.
- 7th—Try to meet from other county resources requests for additional farm help coming from local farm labor agents.
- 8th-Render a weekly report to the State Farm Labor Agent on form No. 4.

SEARCH FOR ADDITIONAL LOCAL SOURCES OF LABOR

Efforts to find potential supplies of labor in California resulted as shown below.

State Prisons.—At a conference with Warden J. A. Johnston of San Quentin the policy of the state for the utilization of men under sentence was determined to be as follows: Only paroled men are available for private concerns, singly or in groups of not more than three or four; permanence of the job essential; men must make a report weekly to Parole Officer, otherwise are exactly like free citizens; employer expected to sign statement regarding wages and conditions and indicating his readiness to notify the officer if the employee is in danger of "slipping."

Warden Johnston is very anxious to place San Quentin prisoners on the farm. Men are never released to work for a private concern under guard. In every case it is the idea to get the men away from the prison atmosphere, and to avoid exploitation. Wages, housing conditions, etc., are contracted for exactly as with free labor, the prisoner accepting or declining the offer, as he sees fit.

The most important limitation on the other side is the small number of farmers who will knowingly employ paroled prisoners. Transportation expenses are generally forwarded by the employer who in some cases demands that the prisoner refund this from his first check.

The normal output of paroled men is from forty to fifty per month, but if the demand for labor exceeds the normal, it may be possible to let out a larger number, as availability of work is a controlling factor with the Parole Board. Folsom is governed by the same rules, and about half as many paroled men are available.

Dependents, convicts not subject to parole, mental defectives, and other such people can be utilized to good advantage only if worked in groups under direction of those capable of handling them. Men of this class cannot be scattered individually throughout various farms, because the average farmer cannot closely supervise their work or prevent their escape, nor does he care to trust them with valuable stock or implements.

The regulations as outlined above definitely restrict personal use of this sort of labor.

Highway Work.—Highway work in California is prosecuted most actively during the months when the farmer is in sharp need of teamsters. Inquiry into the possibility of curtailment by the Highway Commission, last summer, resulted as follows:

No men or teams were available for release from maintenance and repair work, and no contractor could be expected to release any men or stock from units now under construction, for the following reasons:

- 1. Constant pressure from Washington to hasten building and keep up with repairs, in view of possible military contingencies.
- 2. Necessity of continuing all highway work in interest of the farmer himself and of the community—i.e., of giving best possible opportunity of moving his crops rapidly, safely, and cheaply.

Later advices indicate, however, that highway work must be materially reduced because of a railroad embargo on gravel, cement, and other such material. This should increase perceptibly the supply either of work stock, or of teamsters and other able-bodied laborers.

Men from Alaska.—About 4500 men employed on the Alaskan Coast in fisheries and canneries come down every year to San Francisco. They begin to move in about the middle of September and are all back within a month or six weeks. The Mexicans and Filipinos, numbering perhaps 1000, appear to drift rapidly into the beet fields. Many of the other men are not available for several weeks, or until their earnings are gone. Nothing could be done this season to increase the number or efficiency of laborers from this source, although the supply offers possibilities if rightly handled.

Supplying Additional Labor.—The actual amount of additional help either the State or County Farm Labor Agents have been able to develop has been small. Something was accomplished in arranging for use of high school and Y. M. C. A. boys, in obtaining negroes for cotton picking from the vicinity of Los Angeles, and in a few other minor ways. Texas and Oklahoma families have been brought in by the Imperial Valley growers working through their County Farm Labor Agent.

The best work has been brought about, not by increasing the amount of help—although this is much to be desired—but in a better utilization of the help already available. Each county agent has to a large extent been able to act as a clearing house for his community and has in this way brought many employers and employees together. Together, the State and County Farm Labor Agents placed a total of 4615 workers.

Plans have been set going by this office for certain conferences this winter that should lead to a wider and more satisfactory utilization of available "marginal" labor during the coming crop season in case of need.

Reduced Transportation Rates.—Convinced that California agriculture suffers from lack of labor mobility—since the crops develop in more or less regular cycles, to harvest which successfully requires much traveling from place to place on the part of laborers, while many crops are so far removed from centers of labor supply as to make it impossible for men to pay their fares—the desirability of granting reduced rates to farm help has been urged upon the railroads.

It is hoped that something may yet be done to render paid transportation cheaper for the migratory worker, whether through reduced rates, or the introduction of second and even of third class coaches, or the wider development of auto-bus traffic.

Training School.—To bring about an increase in the number of trained farm hands, arrangements were made on September 11th with the University Farm at Davis to provide instruction for men desiring to learn how to milk, drive team, run Fresno scraper, irrigate, or do general farm work. Facilities are available for fifteen men who will live under regular ranch conditions.

Word passed to members of the College of Agriculture faculty, including the Farm Advisers, and to various individuals so situated that they could bring the matter to the attention of anyone interested, did not result in a single application. A state-wide publicity campaign was therefore inaugurated (October 18th), the net results of which to date are only sixteen requests for information and six applications. Two men have been sent to the farm thus far, one of whom immediately changed over to the Tractor Short Course then being given, while the other is at work.

In sending information to prospective applicants it is pointed out that:

"The course of training will cover sufficient time to harden men and develop sufficient skill to insure their successful employment upon ranches. The kind of work will be largely optional with each individual so far as conditions for giving instruction will permit. Applicants for this course will fill out Form F S No. 1.

"Applicants will pay their own transportation and provide their own blankets. They will then be given one week's trial to see how they take to the work and to test out their fitness. They may leave at the end of that time. If, however, the applicant gives reasonable promise of making a success of ranch work, and if he desires to continue the training, it is expected that the applicant will then agree to stay until he is ready to enter actively into agricultural work and will give reasonable assurance that he will take up the work. Board and lodging will be furnished free. No charge will be made for training, and no payment made for work done by applicant when training.

"Attempts will be made by the State Farm Labor Agent to place men to advantage, and the demand is usually such that all will be employed, although no definite promise can be made of employment. It may be pointed out that courses are offered only along lines where a real shortage of labor is already apparent."

Applicants are required to fill out a form as follows:

Form F. S. 1

Application for Admission to Farm Labor Practical Training School Davis, California

Please consider me an applicant: Name of applicant Nationality Mail address Telephone Previous training in agriculturef Previous experience in agriculture? Know anything about farming? Reason for going to school? Expect to enter active work? Wages expected in active work? Any dependents? Your physical condition?.... If tried for one week and considered satisfactory for additional training, will you promise to stay till end of work if continued?..... When can you start training? Personal interviews follow the submission of an application and only men having outward evidences of being willing and able to develop successfully will be chosen.

INVESTIGATIONS INTO WAGES, HOUSING, HOURS, BOARD AND SUPERVISION

Introduction.—So much adverse comment has come to us upon the failure of many California ranchers to provide a going wage, decent housing, proper board, reasonable working hours, and ability to handle men, that we have made most careful inquiries into the merits of these statements.

Twenty-six experiences were collected from university students who had worked on ranches under men other than relatives. These students were able to present clear-cut points of view, and in most instances presented their deductions without feeling or bias. The experiences are classified under: Treatment by foremen, work hours, food, and living quarters. A summary of the various experiences resulted in the following answers:

Treatment by foremen: Satisfactory, 21; fair, 3; poor, 2. Working hours: Satisfactory, 23; too long, 3; too short, 0. Food: satisfactory, 15; very good, 2; not satisfactory, 9. Living quarters: Satisfactory, 8; very good, 5; unsatisfactory, 13.

Based on percentages satisfactory conditions were reported:

Treatment by foremen81%	Food65%
Working hours88%	Living quarters50%

So far as these experiences are indicative they tend to eliminate the lack of ability of foremen to handle men and do not bear out the contention that the working hours are too long. They do, however, emphasize the fact that food and living quarters demand more consideration.

Extracts from the experiences referred to above may be of interest.

FOREMEN'S RELATIONSHIP TO MEN

- (1) "When I first landed on the job the farmer walked about the place with me, talking incessantly and telling me he had changed the place from a desert to its present state. From that time on he never acted as friendly except on days when he had been in town."
- "He generally set us to work on new jobs in the morning after breakfast. His directions were brief but usually very indefinite, so that we often worked quite a while without being sure that we were doing the work to suit him as for instance: 'You fellows can go to work on that ditch on the last forty. Take four mules with you. It's the old ditch running past the potato patch.' With that he was off with a bang, and seldom spoke of the work until we came in with the implements. He never tried to hurry us and even when the work was piling up he seemed to have all the time in the world."
- (2) "The farmer was a fairly good man to work for. He generally acted about the same whether the work was progressing properly or not, but small things, often no one's fault, having no one to blame, would excite him, when he would curse everything in sight, guilty or not guilty. After he had cooled down he would feel cheap and side around to us as much as to ask our pardon. In this way he would lose our respect and cause us to lose interest in things. The Swiss people were less subject to hurt feelings or loss of interest than Americans."
- (3) "In my opinion the men on the ranch were not handled very well and although we were all driven we didn't give as much as we would under a more congenial management. The way this foreman handled us sure showed that men can't be driven and I believe more could have been received from the men had he been a little more 'one of us' and not been such a 'slave driver.'"
- (4) "The foreman was very severe and overbearing, but I ignored him, since all that I wanted was experience, and believe me, I got it. I was sent down well-pits, 100 feet in depth, in mud up to my waist, to examine leaks. On windy days I was sent to the tops of old windmills about 50 feet in height to dismantle the uppermost machinery. He never had a word of encouragement or a smile upon his countenance."
- (5) "No one ever interfered with the men when they were at work. The work was never found fault with nor was the work ever commended. A man might work extra hard in order to finish a job up in a hurry or else take extra pains with the work. However, neither the foreman nor the superintendent would ever say a word about the work to anyone. The same applies to work done carefully as well as work done in a sloppy and careless manner. His orders were usually very short and indefinite. He would seem to take it for granted that the workman could read his mind and could tell exactly where and what was to be done from a very few indefinite orders."
- (6) "The foreman was well educated, had seen a good deal of the world, and knew his business thoroughly. Gave the impression at the start that he was a dependable man who could use his brains and use them to the best advantage. He treated an applicant kindly and with interest, taking up first what the applicant had done in the past, the applicant's ideas on what he wanted to do now, and there explaining what the position was and what he, the foreman, expected of the applicant.

"After working under him for a while one had the same dependable feeling concerning him as at the first. He knew what he wished done and when it was to be done, and expected the man working under him to do the job. And it was usually done in the best way the man could do it."

WORK HOURS

- (1) "We worked about ten hours a day from 6 A.M. to 11 A.M. and from 2 P.M. to 7 P.M. I think that these hours are about right for under those conditions (Imperial Valley), since they were short enough so that both the man and teams could keep it up daily without playing out and at the same time gave us a good rest during the heat of the day. One good thing about these working hours was that they were definite and when we were through we felt free to rest and not as though we should be doing some odd ends."
- (2) "Working hours vary to the kind of work—some days were too long, but as all laborers will say none are too short.
- "Example: I was milking a string and doing a good day's work picking apricots besides—hours too long.
- "Example: I was in Modoc County, California, this summer; one average day's work was about ten hours—satisfactory.
- "Example: The average day's work which I have done was about nine hours—all satisfactory."
- (3) "Working hours were long. Feed and harness team between 5 and 6 in the morning, going to the field at 6:30 or 7, leaving the field at 12 for noon and starting back at 1, then leaving field at 6 and take care of team after reaching the barn. The distance to and from work made the day longer than hours as given indicate."
- (4) "The working hours were on the average eight hours a day. If, however, there was anything extra to be done one was always willing to work extra hours. For it was only for necessary things which were extra and he was perfectly willing to do the job himself if the need arose. Men did not complain as a rule, though some thought the hours too long."

FOOD

- (1) "The food was fairly satisfactory. There was practically no variety whatever in our diet and the food was often prepared by the unskilled hands of the farmer's children. However it was wholesome food and there was plenty of it so we didn't kick."
- (2) "Some ranches and outfits lay on satisfactory grub and some rotten. Example: While working for a cattle man in Modoc County, Cailfornia and Nevada, an instance of bad food occurred only at the home ranch where his stingy wife lived. Bad food and same kind of grub three times a day caused a greater discontent among laborers than anything else."
- (3) "The food was very good with three square meals a day and we certainly needed them."
- (4) "Foreman's wife did the cooking and we had plenty of good, plain, wholesome nourishing food, and it was served at regular hours."
- (5) "The food was exceedingly plain and served only in moderate amounts and with very little variety."
- (6) "The food was very inferior. The milk was skimmed, flavored mainly by the drowned flies contained therein. Steaks were his specialty. If they

were placed on the railroad track they would wreck the fastest train known. They were certainly first-class material for making saddles. Every time I think of Hing Loo I lose my appetite."

- (7) "Food was at times very bad. There was always plenty but the cooking was often very bad. The cook would become very lazy at regular intervals and the food would be correspondingly bad. Every now and then the man in charge of the cookhouse would go after the cook and for a short time the meals would be good. However, as a rule, the food was very poorly cooked and at times not fit for hogs to eat."
- (8) "Food was not very good, that is, not well cooked and was too small in quantity. If you sometimes came late to the table you might, many times, not get enough to eat."
- (9) "The food was excellent. Nothing fancy, but plenty of good, whole-some food. And though sometimes it wasn't cooked enough or perhaps burned, accidents will happen and men of a laborer's class wouldn't notice it if the circumstance occurred only once in a while. There was always plenty of food for all and that is what counts."
- (10) "While we boarded at the home ranch we had plenty to eat and the food was of good quality, but we later took a cookhouse and then our troubles commenced. We moved into a new section and camped at an old abandoned ranch. The water was very poor, as the well was full of sand and dirt. It was also very alkaline. We had a poor cook and half the time he didn't cook enough to eat. The cookhouse didn't have good screens and we had to beat the flies or we lost out on the food. In fact the State Camp Sanitation Inspector could have found several things to interest him if he had happened to visit us."

LIVING CONDITIONS

- (1) "The living quarters were a fright. They were low, dingy, old shacks full of dirt, old shoes and clothes, and specked with chicken droppings where the chickens had roamed or roosted. The place seemed alive with insects and germs. I immediately asked permission to sleep on a haystack nearby, since I had my own blankets together with my belongings, which were wrapped in a large red handkerchief. This I called home except when a thunder shower came along, when the haywagon furnished some covering."
- (2) "The living quarters appear to be a small item to most of the men I have worked for. Example: While working for hay-pressers and threshers I expected nothing more than the hay; but on a well established ranch and employing many men and making good profits, I was given a roll of blankets and told to sleep in the barn. There was no reason why this man could not furnish respectable sleeping quarters."
 - (3) "Good beds were provided in tents outside, which helped very much."
- (4) "The living quarters were very good. Two of the men slept in a small bunk-house, which was kept very neat and clean."
- (5) "The living quarters were rather poor and the beds had bedbugs. I slept in an old wagon filled with straw, using a couple of my own blankets."
- (6) "The living quarters ranked in the same class as the food. A berth in the Pullman consisted of a four-posted arrangement filled with straw, bedbugs and fleas; mostly bedbugs. They would hide in the stalks by day and crawl out of their shell per P.M. and attack their most beloved enemy.

- "Ventilation consisted of 'Union Leader' and 'Bull Durbam' smoke which came in contact with the outer air through the cracks of the wall. Sheets, pillow slips and pajamas were present in minus quantities. Essence of stale beer, whisky and other homogeneous mixtures were present from Saturday night until Tuesday or Wednesday A.M."
- (7) "The living quarters were fine, best in the State according to the help. Each man had an individual room and an iron bed. Gunny sacks served as a mattress. A large reading room was also provided. Secondhand magazines were furnished by some club women in Chico, and I think they were really appreciated by the men."
- (8) "Upon our arrival in the evening we were shown the bunk-house by a wave of the foreman's hand toward the bunk-house and told that the feathers were in the barn. We were told to come in to supper with the men at 6 o'clock.
- "Living quarters were very disreputable—dirty, dusty, and full of fleas and bedbugs, etc. Another man and I came to work at the same time and after one superficial glance at the sleeping quarters we decided to sleep outside under a tree on a pile of hay. Within a week nine other men had moved out of the bunk-house and followed our example of sleeping under the stars."
- (9) "The living quarters were separate rooms for two, with a shower at end of hall. Rough and ready, but comfortable, was a room to lounge in, with 'Snappy Stories,' etc., as a type of reading matter. Papers were taken regularly. Place was kept clean."
- (10) "Bunk-house was filthy and full of fleas. I fixed up a bunk outside, filled it with hay and had a good bed."
- (11) "The men's living quarters were very poor. The bunk-house was old and dirty and slightly infected with vermin, fleas, etc. It had one little window. All the men slept out of doors while I was there, but in the winter time it must be bad. The men ate in the kitchen of the ranch house." Certain Additional Observations are Worth Inserting:
- (1) "I would have to be pretty hard up to work as ranch hand again, because of the shortness of the jobs and while hunting for a job all the profit is taken out of it. I estimate that the year through I averaged \$7.50 a week, though I was not out of work more than the average man; so just as soon as I got enough health to last me a few years longer I went back to my job in the shop in town, which though only \$2 a day then was steady work. Also when working in town I can have a place at least a little bit better than only 'a place to hang my hat.'
- "I don't wonder that many of the 'blanket men' are poor workers, unreliable and averse to staying long at a job. I would probably become one myself if I had stayed in ranch work. Having to change jobs every few weeks or days, having to travel all over the State to get work, is enough to make anyone form the habit of restlessness. The idleness betwen jobs and unhygenic methods of living contribute toward making them poor workers."
- (2) "The influence of contact with the farm hands was not very elevating. A large percentage could not understand English, except when the foreman told them to get a move on or get their time. Most of the conversation consisted of who was the most popular bartender in town, and the one that was the most popular was the one that got you drunk or intoxicated rather, the quickest, or the one who was the most liberal with his wares. Newspapers were read occasionally, the sport and josh pages being the most popular. Each hand had

his tale of woe and explained why he degraded to the level of a farm hand. In eight cases out of ten it was due to the effects of John Barleycorn.

"The men thought only of the immediate present and the coming Saturday night. Of course there were a few good hands that worked conscientiously and saved practically all their wages. These were scarce, being far and few between."

- (3) "Plenty of good, wholesome food, clean quarters, a ready knowledge of the men—'a using from the ranks' proposition—steady work with reasonable hours, some recreation and outside interests. These are a good basis for success in getting a hold of men, together with a personality which the men can like or at least trust and call square."
- (4) "Labor is provided for the men who are kept through the winter in cutting, splitting, and stacking wood in the large barn on the ranch, so that the majority of the hands are assured of steady labor the year round if they do the work required of them in a thoroughly satisfactory manner."

FINDINGS OF THE COMMISSION OF IMMIGRATION AND HOUSING

Since the first of April an average of two field men of the Commission of Immigration and Housing, under the direction of Mr. George L. Bell, have been kept constantly busy inspecting farm labor camps. First inspection of farm help quarters very frequently leads to warning. Re-inspection after warning generally shows that the employer has come up to the standard set by the Commission. The inspectors report that improvement in housing conditions results at once in a more satisfactory and contented class of labor, though not a few progressive employers tell us that in these present times the excellent accommodations they furnish help them in getting, but not at all in keeping, their hired hands.

A difficulty encountered in connection with housing recommendations lies in the fact that the large ranch can often afford to put up housing for all the help that it requires throughout the year while the small rancher, employing perhaps only from one to four or five men the year round, may find it all but impossible to provide favorable facilities for his additional labor in harvest time. The Commission's inspectors report that big operators are quick to note results coming from improved housing, but that the small operator is slow to see its advantages.

It is interesting to note that inspectors say that, in general, farm conditions with reference to housing will not compare favorably with those of other industries.

Due to the kind cooperation of Mr. George L. Bell we are able to present the following findings:

Wages.—As collected by inspectors the wage range for unskilled labor averaged per day for 1917: Agriculture—general ranch work, \$2.00 to \$2.50; sugar beet work, \$2.00 to \$2.25; fruit, \$2.25 to \$3.00. Construction, \$2.50 to \$3.00; highway and grading, \$2.25 to \$3.50; mines and quarries, \$2.50 to \$3.00; railroad, \$2.25.

Sanitary Conditions of Camps.—The sanitary condition of 117 agricultural camps inspected in 1916 classified as: Good, 21%; fair, 28%; bad, 51%. In 1917, 114 agricultural camps were rated as: Good, 18%; fair, 28%; bad, 54%. A comparison of the 1916 figures with those for camps of other industries shows a somewhat similar state of affairs with the balance somewhat against the agri-

cultural camps. For this year 342 camps used in construction, railroad, highway and grading, mines and juarries, and oil averaged: Good, 26%; fair, 34%; bad, 40%.

Nationality of Labor, 1917.—Americans, Japanese, Mexicans, Chinese, Hindus, Italians, Spanish, Greeks, Slavonians, Filipinoes, Koreans, and Indians are reported from the 124 ranches visited by inspectors.

If representation in each of the industries may be taken as a guide, the industries favored, so far as this investigation goes, by different nationalities are in order of choice: Americans, hops, rice, fruit; Japanese, grapes, rice; Mexicans, fruit, sugar beets, grape; Chinese, hops, rice; Hindus, grape, rice; Italians, grape, fruit; Spanish, fruit; Greeks, grapes only; Indians, hops only. Other nationalities have too few individuals reported to permit deductions.

The nativity of labor employed in agriculture for all ranches reported is made up of more than half its numbers of native born in the beet hop and general ranch work and to less than half native born in the fruit and grape industries. Cotton laborers are reported as about equal in numbers of native and foreign born.

Compared with other industries, as construction, highway and grading, lumber, mines and quarries, railroad and oil, the native born in agriculture makes up an average of 51% as against 64% in other industries.

It is interesting to note that 94% of the oil workers are native born.

Nationality Preferred by Foremen.—Totals collected in 1916 and 1917 covering agriculture show, from a total of 241 opinions, no preference on the part of 58% of the foremen, 16% preferring American born help, and 26% favoring foreign born. Of the foremen stating a choice foreign born preferences are expressed by those in charge of grape and beet camps.

I. W. W. Points of View.—George Speed, San Francisco I. W. W. leader, admitted during an interview with representatives of this office that housing and other conditions were improving on the Pacific Coast ranches, but asserted that vastly more improvement was necessary before the laborer would be satisfied. Lack of decent conditions were largely to blame for common laborers' irresponsibility.

Mr. Speed further maintained that the common laboring man has been so much abused by employers and foremen, so "chased from pillar to post," that he had come to feel absolutely no interest in his employer's success. This was largely responsible for his tendency to jump a job before it was done in order to make sure of a new and perhaps more desirable job.

At a meeting November 22nd, arranged by Mr. W. S. Goodrich, of the Oakland Public Woodyard, at which Miss Pollak and Messrs. Esmond, Fox, and Hoffman were present, attempts were made to get the I. W. W. point of view, but nothing further of any substantial value to the present emergency could be obtained.

Pratt's Findings.—As a result of special inquiry into housing conditions and the handling of men, Pratt of this office makes the following statements:

"Employment agents and men frequenting their offices have a very poor opinion of the living conditions on the average farm, and speak far more favorably of those in lumber and construction camps.

"There is some evidence to show that farmers in general fail in comparison with competing employers in tact and ability in handling men, especially the class of men represented by our wandering labor. It should be noted that the

lumber companies compete very strongly with our farmers because our logging is done in the summer and fall.

"On large ranches, particularly, there is apt to be a close connection between the ability of the manager or foreman and the housing as well as the character and efficiency of the employees."

Summer Housing of Men.—During the summer season the majority of farm laborers prefer to sleep out-of-doors and require no housing during the peak of the harvest. The bunk-house is primarily winter quarters. At the time of year when the press of work is the greatest crews are handled only for a short period, which results in the prevailing opinion that ranchers should not be expected to furnish indoor quarters for large summer crews. Failure to provide decent sanitary measures, however, has accompanied lack of housing in too many instances.

On the other hand, there is much evidence to show that the present-day migratory labor strongly resents the lack of roofed quarters in the California harvest season. This is partly because he comes from radically different climatic conditions, partly because he dislikes to carry the bedding required by our cool summer nights, partly because he wants to feel "at home" where he has a job, and partly because all these considerations have been deliberately exploited and capitalized by the agitator.

Laborers Are Careless.—Just grounds for complaint on the part of the farmer may be found in that the itinerant ranch hand in many instances will make absolutely no effort to keep a bunk-house decent. This statement applies particularly to the small employer hiring transient labor for short periods, where the care of the bunk-house must of necessity be left to the laborers themselves.

Investigations into Wages Paid by Industries Other than Agriculture.—During September inquiries by mail were made to learn what wages are paid by industries competing with agriculture for labor. Rates, as submitted to us, reduced to cents per hour, for such industries as oil, iron works, railroad, sugar refinery, road construction, tannery, ship yard, mine, contractor, lumber, powder works, lime quarry, and potash works ranged from 22 to 43.7 cents, including value of perquisites, or a general average of 31.8 cents per hour.

Wages Paid Agricultural Workers.—A good insight into wages offered farm laborers during 1917 is afforded by the records of the Public Employment Bureaus of California. Through the courtesy of the Superintendent, Mr. C. B. Sexton we are able to offer data especially indicative of conditions.

The increased calls for men during the months of July, August and September, 1917, over the corresponding period in 1916 were as follows:

San Francisco Office

Farm	hands applied for, 1917	235
Farm	hands applied for, 1916	88
	Per cent increase, over 160%	
Farm	teamsters applied for, 1917	99
Farm	teamsters applied for, 1916	8
	Per cent increase, over 1100%	

Sacramento Office

Farm hands applied for, 1917	214			
Farm hands applied for, 1916				
Per cent increase, 5%				
Teamsters applied for, 1917	150			
Teamsters applied for, 1916	81			
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The increased amount of wages offered during 1917 over the corresponding period of 1916, based on the above data, is also significant.

WAGES OFFERED APPLICANTS FOR FARM WORK

(Months of July, August and September)

		SAN FRA	ANCISCO		SACRAMENTO			
	Farm	hands	Tean	ısters	Farm	hands	Team	sters
Range*	1917	1916	1917	1916	1917	1916	1917	1916
\$15-\$20	•		••••			1		
20- 25				••••	••••	••••	****	****
25- 30		5			****	7		****
30- 35	3	22	4	4		16	••••	1
35- 40	38	36	1	2	1	134		47
40- 45	20	1		••••		••••	••••	
45- 50	43	•	45		8	10		20
50- 60	61	3	24		118	21	112	8
60- 70	16		3		13	4	2	****
70 and over	2		2	••••		****	1	••••
Rate not set	2	8	••••	••••	2	1	4	

^{*} Board and lodging furnished in addition.

It should be borne in mind that some increase in application is due to the fact that in 1916 the office was new and farmers were not fully acquainted with its scope. The most remarkable evidence is offered by the increase in wages. In 1916 the bulk of wages offered by farmers applying to the San Francisco office was between \$30 and \$40. In 1917 it ranged between \$45 and \$60, with a good showing in the \$35 to \$40 group.

At Sacramento the bulk of applications offered between \$30 and \$40 in 1916 for farm hands and between \$50 and \$70 in 1917.

Applications to San Francisco office for teamsters offered for the few demanded in 1916 a range of \$30 to \$40, while in 1917 the range was from \$45 to \$60. At Sacramento applications for teamsters in 1916 offered wages from \$35 to \$50 and in 1917 from \$50 to \$60.

Other Examples of Farm .Wages.—Investigations into various wages paid for ranch labor showed that in southern California during September rates were about as follows:

L	ength	Value	Value	Rate	
Kind of work of	day	wages	board	per hour	Year
Cutting corn	10	\$3.25	\$1.00	42.5c	1917
Harvesting sugar beets	9	2.25	••	25.0c	1917
Bean harvest-Roustabouts and sack					
tenders	10	2.50	.75	32.5c	1917
Bean harvest-Spool tenders	10	2.75	.75	35.0c	1917

Dixon grain farmers offered the past season for the three or four weeks of bucking sacks \$3.00 to \$3.50 and board.

Samples of rates offered for ranch labor as posted on the State Employment Bureau bulletins at Fresno, September 22nd, were as follows:

Ranch hands, \$2.00 and board.

Hay pitchers, \$2.00 and board, free fare.

Muckers and miners, \$2.25 and board.

Unload cars, \$2.75 without board.

Power construction, \$2.75 and board 75c (for the San Joaquin Light & Power Co.).

The average wage paid by fruit growers was from \$2.50 to \$2.75 per day and board, but the jobs only lasted sixty days at the longest. This year the peaches and grapes came at the same time, so that the period of work was shorter than usual. Men preferring to work at piece work rather than by the day, were paid rates set by the Valley Fruit Growers' Association.

Thirty-six dairies in the vicinity of San Francisco and Oakland answering questions concerning costs entering with 1917 milk production show a range and average monthly wage, board in addition, in payment of labor as follows:

	Number dairies	Range	Average
Milkers	26	\$45-\$80	\$58
Farm hands	20	35- 75	50
Cooks	. 14	*20- 80	43
Foremen	9	75-125	100

^{*} Low limits probably paid to foreman's wife.

Attempts by Farmers to Fix Wage Scales.—Two instances of new attempts on the part of farmers to fix wage scales came to our attention during the past season.

San Fernando farmers in convention at Van Nuys, July 21st, set the wage for sugar beet harvest on a sliding scale of 80 cents per ton as a standard for 10-ton crop, varying with the tonnage from 55 cents for 18-ton yields to \$2.35 for three-ton yields. It was agreed by all to stand by the scale.

At the same meeting teamsters were raised from \$1.50 to \$1.75 when employed in handling six or eight-horse teams hauling beets for a ten-hour day; board and lodging in addition. The scale for irrigators was set for 25 cents per hour, with board and lodging.

The Valley Fruit Growers' Association, with headquarters at Fresno, established the following wage schedule for the 1917 season, from which ranchers determined not to deviate.

Time rates:

July	25c	per	hour
August	27½c	per	hour
September	30с	per	hour
Piece work, or contract work:			
Picking peaches	\$2.0	0 pe	r ton
Picking grapes: Standard crop of	1-11/4	trays	per
vine, Muscats 3c per tray; Thom	pson See	dless	and
Sultanas	2½c	per	tray

Bonuses.—The practice of paying bonuses for length of service is growing in the state. Examples were found at the Elwood Ranch, Santa Barbara; the Van Loben Sels Ranch, at Vorden; the Meek Ranch, at Antioch; in certain sugar beet fields, and in berry fields at Sebastopol.

Investigations up to this date will not permit the drawing of conclusions, since there appears to be evidence both for and against the efficacy of bonuses. Some who have heretofore used the bonus system have abandoned it for the present in the case of new employees, since they claim that it has had no effect whatever upon getting men to stick to the job.

Farmers' Results with Better Housing.—To determine to what extent better housing has influenced their labor supply we sent a letter during October to twenty farmers who, following instruction from the Commission of Immigration and Housing, had undertaken to provide satisfactory accommodations.

Eight replies have been received. Mr. Geo. C. Roeding, of Fresno, permits our quoting him:

"(1st). It is impossible for me to say definitely that the changes I made in following the suggestions of the Commission of Immigration and Housing have paid as far as the employment of help this year was concerned. On general principles I want to say that I am decidedly of the opinion that it is of the utmost importance to make the housing conditions for farm laborers better than they have been on the farms as a whole in California. One of the discouraging features has been the difficulty of making laborers understand and appreciate the efforts of employers in this direction. The roving element is not any too clean as it is, and they are in many instances lacking in appreciation when they are given more satisfactory quarters than they have ordinarily been accustomed to.

"For the welfare of the farming interests of this State, every effort must be made to make the white help understand that it is to their interests to become identified with the places where they are employed, and in order to do this it is my candid opinion that the employer should make the housing conditions of such a character that the employees will understand that their employer is personally interested in their welfare.

"(2nd). I would certainly recommend that farmers throughout the State do everything they possibly can to make their housing conditions so satisfactory that their laborers cannot find fault with their conditions. The recommendations made by the State Commission of Immigration and Housing are certainly of such a character that there is no reason why they should not be followed on all our farms.

"One of the difficulties they will have to overcome is to convince many of the farmers themselves that cleanliness and more careful attention to the housing of their tools and implements, as well as of their men, will redound to their benefit in more ways than one.

"The farmers have certainly reaped a great harvest this year and they are in a more prosperous condition than they ever have been, and if there ever was a time to inaugurate a campaign to improve conditions, it seems to me that time has arrived, and measures should be taken to cause the farmers of California te rigidly obey the recommendations made by the Commission of Immigration and Housing."

The other letters summed up as follows: All but one farmer think that better housing has paid both in obtaining and in holding labor, and they recommend to farmers generally that they improve conditions.

Bringing in Labor under Contract.—H. A. Cable, Deputy Commissioner of Labor Statistics, with offices in Los Angeles, is authority for the statement that there is nothing in the statutes to prevent a firm from bringing laborers in from another state under contract, no cash wages to be paid until passage money advanced shall be worked out, it being assumed, of course, that the laborer as well as his employer is perfectly familiar with the terms of his contract.

Mr. Cable also says that a laborer quitting his job under such a contract before he has worked out his passage money has no legal claim for wages up to the time of quitting; on the other hand, that his employer has just cause for a civil suit in such a case for non-fulfilment of contract. It is interesting to note that a case of this kind has recently arisen at a quarry in San Bernardino County, where laborers imported from Missouri to do quarry work quit before working out their passage money. These men were apprehended, lodged in jail and charged with obtaining goods under false pretentions, the men having quit almost immediately upon their arrival at the quarry, evidently having used this job as a means of obtaining free transportation without any real intention of going to work. The justice of the peace who heard the case dismissed it. These men then took steps through the State Bureau of Labor Statistics to collect wages alleged to be due them, but after the lapse of six weeks or more the wages have not been collected and yet no suit has been instituted.

LOSSES DUE TO SHORTAGE OF LABOR

Evidences of Losses.—The real test of labor shortages comes at the conclusion of the season when results of the year's work may be summed up. There are four possible classes of losses.

- (a) Losses in total production through non-utilization of idle lands, due to failure to plant, or the sacrifice of the crop through inability to care for it during growth or at harvest.
- (b) Losses in quantity due to delayed seeding, cultivation or harvest, i.e., poor stands, alfalfa cut too ripe for use, grain shattering, fruit over-ripe.
 - (c) Losses in quality due to delay, i.e., potatoes sprouting, fruit over-ripe.
- (d) Losses due to non-utilization of land for a second crop because of delay in removal of first crop from lack of help.

There may be other classifications worth adding but this will serve for the present as a general working basis.

The kind and extent of losses in food products directly traceable to lack of labor are difficult to estimate and yet the extent of loss is of vital need in determining labor. It is somewhat difficult, if not impossible, to distinguish between losses due to lack of labor and to usual climatic vagaries, or to the presence of weeds, diseases or insects.

Believing this test to be the real crux of the situation every effort was made to determine something of the losses resulting from labor shortage.

Evidences of losses have been sought in several ways, chief among which were:

- (a) Investigations in the field by representatives of this office.
- (b) Requests in October of twenty farm advisors for statement of losses then known to them.
- (c) Institution of a month of farm center meetings during November by farm advisors to unearth all possible evidence of losses.
- (d) Requests of twenty-two county farm labor agents other than farm advisors for statement of losses as determined by them (November).
- (c) Personal letters to 150 farmers in different parts of the state asking for their experiences (November).
- (f) Requests of the College of Agriculture faculty, the Commission of Immigration and Housing and organizations in touch with farming conditions (October).

Full details of the investigation are on file in the office, with sample blanks and accompanying letters where they can be consulted since lack of space necessitates their exclusion from this report.

In general, the investigation was conducted to gather information as to:

Losses in 1917 in acreage due to inability to plant because of a shortage
of labor.

Losses in 1917 in quantity due to a shortage of labor (i.e., grain shattering, alfalfa over-mature, fruit dropping, loss of acreage or yield from weeds or from inability to cultivate, etc.).

Losses in 1917 in quality due to shortage of labor (i.e., weed seed present, fruit over-ripe, inability to thin or cultivate, etc.).

Shortage of labor indicated by higher wages paid in 1917 over 1916 for similar work and during comparable periods of time.

Shortage of labor indicated by

- (a) Providing better housing in 1917.
- (b) Providing better board in 1917.
- (c) Providing readjustment of hours in 1917.

Opinions concerning effect of 1917 labor shortage on acreage production in 1918.

Effect of military draft on 1918 crops and industries.

Efficiency of labor 1917 compared with 1916 and causes (i.e., drink, discontent, too many jobs open, etc.).

Recommendations to meet 1918 needs.

A statement as to the number of farmers (if a center meeting), acreages represented, number of laborers normally employed, and type of farming formed a part of the inquiry.

SCOPE OF INVESTIGATIONS INTO FINAL OUTCOME DUE TO LABOR CONDITIONS

Farm Centers.—During November, 132 farm center meetings discussed the labor situation, these meetings being located and attended as shown below:

ATTENDANCE AND ACREAGE, FARM CENTER MEETINGS

County Fresno	Center Raisin	Attend- ance 20	Laborers usually employed 60	Acreage repre- sented 3,000	Type of agriculture General farming and fruit.
	Selma	30	600	5,000	Vineyard and orchard.
	Kerman	8	81	620	General farming and fruit.
	Reedley	50	500	2,000	Fruit.
	Fowler	10	240	750	Fruit.
	Parlier	8.	269	670	cruit.
	Sawyer	12	600	1,200	Fruit.
Glenn	. Bavliss	30	Variable	1.200	General farming, dairying.
	Ord	16	Variable	2,560	General farming, dairying.
	Larkin	*	Variable		*A canvass of the district.
	Orland		Variable		
Humboldt	Loleta	60	148	7,127	General farming, dairying.
	Bavside	39	15	3,689	General farming, dairying.
•	Arcata	122	109	6,841	General farming, dairying.
	Ferndale	28	56	2.000	General farming, dairying.
	Fortuna	35	40	2,000	General farming, dairying.
	Shivley	20	Very few	400	Truck, dairying.

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ATTENDANCE AND ACREAGE, FARM CENTER MEETINGS-(Continued)

County	Center	Attend-	Laborers usually employed	Acreage repre- sented	Type of agriculture
	Verde	20	25	2,000	Cotton, alfalfa, milo maise.
	Eucalyptus		None	580	Grain, general farming.
	Meloland		None	600	Dairying.
	Mesquite Lake		None	1,600	Dairying, grain.
	Westmoland	16	15	1,700	Dairying, grain, alfalfa.
	Calipatria	25	100	2,500	Cotton and grain.
	Magnolia	17	85	2,500	Cotton and grain.
	Mt. Signal	12	25	1,500	Cotton.
	McCabe		7	2,500	Dairying, corn, cotton.
	Seeley	25	40	4,000	Dairying, corn, cotton.
	South Fern	20	17	2,000	Cotton, dairying, gen. farming.
Kern	Kern Delta	22	12	1,790	General farming.
-	Edison-Fairfax	14	25	1,222	Alfalfa, grain, vegetables.
	Rio Bravo	6	7	870	Alfalfa, Egyptian corn, rice.
	Delano	6	10	842	Alfalfa, dairying, wheat.
	Wasco	81	87	2,629	Alfalfa, dairying, wheat, fruit.
	Tehachapi	6	30	2,820	Wheat and barley.
	Rosedale		21	790	Wheat and barley.
	Arvin	6	60	1,810	Wheat and barley.
	Pond	23	18	2,160	Wheat and barley.
Madera	Dairyland	10	28	800	General farming.
	Alpha		25	1,000	General farming.
	Fairmead	21	1	600	General farming.
Merced	El Nido	17	10	450	Dairying, grain.
	Le Grand	12	85	5,000	Fruit, grain, general farming.
	Dos Palos	10	25	1,000	Grain, dairying.
	Cottonwood	40	110	7,000	Grain, dairying.
	Planada	12	25	2,500	Grain, dairying, fruit.
	Delhi	16	40	1,200	Grain, dairying, fruit.
	Amsterdam	9	10	450	Dairying, general farming.
	Stevinson	8	16	1,000	Dairying, general farming.
	Irwin	15	80	550	Fruit, dairying, gen. farming.
	Winton	50	100	1,800	Fruit, dairying, gen. farming.
	Livingston	16	50	1,800	Fruit, dairying, gen. farming.
Napa	Coombaville	12	75	•••••	1 1 1 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
	Soda Canyon	15	•		Fruit and general farming.
	Calistoga	10	Ť	800	Fruit and grapes.
	Spring Valley	13	6		
	Chiles Valley		11	983	Grapes, grain, fruit.
	Carneros	85		9,085	Grapes, grain, fruit.
Nevada	Limekiln		11	4.000	Stock ranges.
	Gold Flat		10	900	Fruit, vegetables.
	Clear Creek		4	4,800	Stock raising, grain, hav.
	Chicago Park		21	1,500	Fruit.
	Penn Valley		19	6,000	Stock raising.
	Indian Flat		9	1,900	Stock, grain, hay.
	Forest Springs		1	1,000	Stock, grain, hay.
	Peardale		7	8,000	Stock, fruit.
	Birchville		2	400	Stock, grain.
Placer	Mt. Vernon		800	1,400	Fruit.
	Loomis		800	450	Fruit.
	Mt. Pleasant		100	540	Fruit.
	Allen		25	1,717	Fruit, grain.
	Gold Hill		56	788	Fruit, grain.
	Weimar		48	1,200	Fruit, grain.
	Sheridan		80	1,600	Fruit, grain.
Riverside				*******	Fruit, walnuts.
	Elsinore			1.500	Fruit, walnuts.
	Perris	10	45	1,500	Alfalfa, grain, milo maize.

ATTENDANCE AND ACREAGE, FARM CENTER MEETINGS-(Concluded)

County	Center	Attend- ance	Laborers usually employed	Acreage repre- sented	Type of agriculture
Riverside	.Banning	19	•••••	•••••	
	Nuevo	21	80	5,000	Fruit, potatoes, truck
	Fruitvale	14	•••••	•	Fruit, general farming.
	Jurupa	102			
	Little Rock	54	•••••		
	Arlington	12	*****	•	Fruit, general farming.
	Coachella	40	•		Alfalfa, truck, dates.
Sacramento	Elverta	20	36	1,000	
	Elk Grove	9	8	975	Fruit and grain.
	Arcada	8	45	•••••	Grain, fruit.
	Galt	_	75	8,000	Grain, fruit.
	Rio Linda	25	4	1,000	
	Consumne	7	12	5,000	Grain, general farming.
	Fairoaks	4	25	700	Fruit.
Gan Tonouin	Escalon	48	50	1,500	
Sau Joaquin	i company and the company and	7	30	1,300	Alfalfa, dairying, fruit. Fruit.
	Acampo	8	18	1,280	
		11	12	-	Grain, alfalfa, beans.
	Bellota		90	888	Grain, alfalfa, beans.
	Lockeford	50		11,000	Grain, dairying, fruit.
	Ripon	26	30	7,000	Alfalfa, dairying.
	Manteca		100	4,500	Beets, alfalfa, gen. farming.
	Linden	25	50	8,500	Fruit, grain.
	Farmington	41	45	7,000	Grain, fruit.
San Bernardino	Fontana	21	24	1,500	Fruit. beans.
	Highlands		10	750	Citrus fruit.
	Chino	58	65	1,765	Hay, grain, beets, fruit.
	Daggett	24	20	500	Alfalfa.
	San Bernardino	25	20	850	Alfalfa, fruit.
	Lucerne	15	8	800	Alfalfa.
San Diego	. Potrero	13	8	1,600	General farming, bees.
	Alpine	10	4	650	Fruit, grain.
	Jamul	8	5	800	Grain, general farming.
	Jamacha	6	15	1,600	Grain, general farming.
	Del Mar	5	6	700	Beans, grain.
	Encinitos			•	
	Bonsall	7	0	1,690	Grain, general farming.
	Fallbrook		0		Grain, general farming.
	Escondido	5	. 8	125	Orchard.
	Poway		15		Fruit, grain.
	Lakeside		14	1,200	
	Ramona		5	1,000	Grain, dairying.
Solano	. Solano	22	10		Grain, stock.
	Fairview	30	10	1,200	General farming.
~	Claus	15	15	450	General farming.
	Patterson		25	1,000	General farming.
	Jennings		17	1,400	General farming.
	-	50	50	1.000	-
	Keyes		16	750	General farming.
	Denair		20	1,200	General farming. General farming.
	Hughson	•		•	
Wala.	Mt. View		50	2,000	General farming.
1 010	Clarksburg	17	•••••		
	West Sacramento	18		•••••	
	Madison			*******	•
	Zamora			•	
	Winters			•••••	Fruit.
	Dunningan	80	*****		Grain.
	Willow Oak	10		•••••	
	Totals	2,987	5,982	224,521	·

County Labor Agents other than Farm Advisors.—Of the twenty-two counties organized with County Farm Labor Agents other than Farm Advisors, twelve reported, as follows:

REPORTS FROM COUNTY FARM LABOR AGENTS OTHER THAN FARM ADVISORS

County	Reported by	Date	Acreage	Agriculture
AmadorG	eo. Woolsey,	10/25	*********	Fruit, grain, general.
	Ione.			
Del NorteE	D. Doxsee,	10/29		
	Crescent City.			
El DoradoE	. J. Kotak,	11/13	10,590	Fruit, grain, special.
	Placerville.			
MendocinoC	. Van Dyke,	10/29	•••••	
	Ukiah.	•		
PlumasV	V. B. Perry.	10/28	7,780	Hay, grain, vegetables,
	Greenville.	•	•	fruit.
(covering northern 1/4	of county	•)	
San BenitoL		10/25	64,122	Alfalfa, fruit, grain, hay,
	Hollister.		•	beets, seeds.
San Luis ObispoS	. V. Christienson,	10/24	119,169	Beans, grain, hay, beets,
•	San Luis Obispo.		·	potatoes.
Santa CruzC	J. Rodgers,	11/1	**********	•
	Watsonville.	•		
Sierra	R. H. Lewis.	10/24	*********	
	Loyalton.	•		
SiskiyouV	V. L. Kleever.	10/29	152,000	Hay, grain, potatoes, fruit,
•	Yreka.	•	•	general.
Sonoma	D. E. Brenner,	10/28	75,000	Fruit, hops, grain, corn,
	Santa Rosa.		,	tomatoes.
Tulare	hairman, Board	11/21	*********	
	of Supervisors.	•		

Private Firms.—Seventy-three firms replied to our communications, details of which are given immediately below:

FIRMS REPORTING

Ņo.	Name of firm	Address of firm	Principal crop	Acreage operated	No. men normally employed
1	Azusa-Foothill Citrus Co.	Azusa	Citrus fruit		
2	Anderson, E. B.	Walnut Creek	Deciduous fruit, nuts	120	8-50
3	Ayer & Pressley Co.	Windsor	Deciduous fruit, grapes	105	
4	Alameda Sugar Co.	310 Sansome St., San Francisco	Beets	9000	
5	Balfour-Guthrie & Co.	San Francisco	Alfalfa		
6	Bancroft, Frank W.	Concord	Deciduous fruit, nuts grain	456	15-100
7	Burger, B. E.	Placerville	Fruit, potatoes	140	3
8	Bardin, Oliver P.	Salinas	Beets, barley, alfalfa	230	3-8
9	Bardin, Jim & Henry	Salinas	Beans, barley, alfalfa	1000	10
			(1	7,000-stoc	k)
10	Bonner Packing Co.	Fresno	Oranges, olives	60	2-3
11	Blanchard Investment Co.	Santa Paula	Citrus fruit, beans	140	
12	Brown, Alex.	Walnut Grove	Fruit, truck, beans, potatoes	2800	200–240
13	Cottage Garden Nurs- eries	Eureka	Alfalfa, potatoes, hay, corn, dairying	300	25
14	Coates Nursery Co.	Morgan Hill	Fruit, nuts	90	10

FIRMS REPORTING—(Concluded)

			•		No. men
No.	Name of firm	Address of firm	Principal crop	Acreage operated	
No. 15	Clark, Frank C.	Laytonville	Nursery stock	operated	· omployed
16	Calif. Packing Corpor-	Daytonvine	Hay, fruit, truck, grain	10.000	Up to 600
	ation		,,,,		
17	Dairy Farms Co.	Modesto	Alfalfa, beans, dairying	530	. 5–12
18	Fred S. Ewer Co., Inc.	Rutherford	Grapes, beans, hay, fruit		5-10
19	Emmert, M. S.	Dunnigan	Grain, nuts, grapes	880	4-12
20	Foster, Chapman	Salinas	Beets, barley, alfalfa	500	3 and contract
					labor on beets
21	Ficklin, Walter C.	Kerman	Grapes, peaches	50	2-9
22	Gammon, E. A.	Hood	Fruit, hay, stock	1000	10-127
23	Guillow, Rene	Windsor	Hay, corn, beans, potato		2-5
24	Gaines, C.	Fresno	Grapes, peaches	160	2–30
25	George, J. W.	Petaluma	Poultry	28 4000	2 200–800
26	E. Clemens Horst Co.	San Francisco	Hops, barley, potatoes, beans, corn		
27	Humphrey, A. B.	Escalon	General farming	800	20
28	Hersman, H. S.	Gilroy	General farming	550	r 0r
29	Hagemann, A.	Livermore	General farming	780	5–25
30	Hiatt, Amos	Ceres	General farming Wheat	450	2
31 32	Iverson, Mat Jameson, W. H.	Union Corona	Fruit, barley, alfalfa,	1000	•
	·		beans		
33	Loma Rica Ranch	Grass Valley	Fruit, beans, hay	400	5–10
34	Laidlaw, G. G.	Ontario	Oranges, peaches, hay, walnuts	35	2
35	Lewis Dairy Co.	San Luis Obispo	Hay, dairying, beans	400	4
36	Miller & Lux	Los Banos	Alfalfa	30,000	300-600
37	Mel, Louis	1438 Third Ave.,	_		
		Oakland	Grapes	139	2-6
38	May, Henry	Decoto	Hay, grain, fruit, vege- tables		
39	Maywood Colony	Corning	Fruit, alfalfa, stock	480	10
40	Moorland Farm	Milpitas	Beets, vegetables		_
41	McNamee, W. H.	Oroville	Figs, oranges	25	1
42	C. C. Morse & Co.	737-759 Front St., San Francisco	Seed		
43	John McArthur Co.	McArthur	Hay, grain, stock	24,000	15-40
44	Moulton Irrigated Land Co.	Colusa	Beans, corn, rice, barley, alfalfa, beets	20,000	200
45	Miller, Guy H.	Modesto	Alfalfa	75	2
46	Neff, J. B.	Anaheim	Walnuts, oranges	60	2–15
47	Oroville Orange & Olive Growers	Palermo	Oranges, olives		
48	Old River Farms Co.	660 Market St., San Francisco	Barley, beans, beets	3600	125
49	Ogier, J. B.	San Jose	Hay, alfalfa, fruit	1520	10-15
50	Post Card Ranch		Stock, dairying	640	12-15
51	Pacific States Corp.	Broadway at 8th St., Los Angeles	Beans, alfalfa	6000	150-200 besides labor in beets
52	Porter, Robert	Salinas	Potatoes, tomatoes		
53	Rindge Land & Nav- igation Co.	Stockton	Vegetables, corn, barley,	21,300	300
54	Rancho Sespe	Sespe	Beans, walnuts, citrus fruit	1500	110
55	River Farms Co.	Crafton	Barley, wheat, rice	18,000	110
56	Sancomb, Frank	Durham	Grain, fruit	_0,000	
57	Stanford Ranch	Durham	Grain, rice, beets, alf-	80,000	430-789
			alfa	•	

FIRMS REPORTING—(Continued)

No.	Name of firm	Address of firm	Principal crop	Acreage	employed
58	Spreckels Sugar Co.	Spreckels	Beets, beans, barley	32,876	White ranch
					labor;
					200-500
			•		Asiatics
59	Shuey, G. R.	Independence	Beets, ni'alfa, hay	1200	20
60	Shafter Estate Co.	lnverness	Beets, dairying, hay	,	40–60 milkers
61	Schultz, Fred W.	Williams	Barley, wheat	4500	8
62	San Joaquin Fruit Co.	Fustin	Oranges, walnuts, beans	1000	70
63	Scott, Magner & Miller	Lakeville	Hay, stock	2100	10–20
64	Thatcher, E. S.	Nordhoff	Citrus fruit	134	8-20
65	Thurber, E. R.	Vacaville	Fruit	140	8-28
66	Union Sugar Co.	San Francisco	Beets	7021	178
67	Wrightson, H. W.	Fowler	Grapes, raisins	43	15
68	Wilson, F. H.	Dinuba	Fruit	750	38
69	Woodward, L.	Campbell	Fruit		
70	Webber Bros.	Byron	Corn	1200	10
71	Wood & Co.	Danville	Hay, grain, fruit, stock	1830	10-15
72	Wheeler, John H.	St. Helena	Grapes, walnuts, dairyin	g 250	4-40
78	Willoughby	Calexico	Corn, stock, alfalfa, barle	200	2
			Total		4592
			8	48,432	
			Average	5,622	

In reviewing the answers received to our inquiries it is necessary to bear in mind the effect of the hot weather in July, which, by reducing crop yields of southern California, also curtailed labor needs to a point that early estimates of expected shortage at harvest time did not materialize. A very dry fall also helped the labor situation because no demands were necessary for much help for limited periods which in ordinary years of early rains causes a very definite need which must be reckoned with.

Full detailed tables are presented only in connection with the discussion of "Losses Due to 1917 Labor Conditions" and "Effect of 1917 Labor Conditions upon 1918 Crops and Industries." Careful tabulation of the other material collected in these investigations has been made. Although omitted here because of lack of space, the additional tables are available in this office for consultation.

INQUIRY INTO LOSSES DUE TO LABOR CONDITIONS OF 1917

The investigations into losses due to 1917 labor conditions are presented in full, (1st) as analysis and summary, and (2nd) as full tabulated details.

Analysis and Summary.—In general the total evidence shows a remarkably small number of cases of actual loss. The data is significant in that losses are the exception rather than the rule. Vaca Valley and certain firms operating extensively offer the only evidences of general losses of moment. The great majority of farmers represented in the reports show only minor or local losses.

The large operators offer more evidence of losses than do the Farm Center and County Farm Labor Agents other than Farm Advisors. To make complete deductions, losses of normal times should be taken into account, which, unfortunately, are not available for use in connection with these data.

IMPROMPTU FARM ADVISOR ESTIMATES

Only one Farm Advisor presented an impromptu estimate of crop losses. Summary of his county—Yolo—indicated that the effect of labor shortage resulted in:

- (a) No decrease in acreage.
- (b) Two cases of inability to procure a second crop, amounting, in one case, to \$3000, and in the other to 100 acres, equally divided between beans and silage corn.
 - (c) One case-\$2500-of overripe fruit.
 - (d) No loss in quality or in harvest.

FARM CENTER REPORTS

The Farm Center reports cover 132 centers having an attendance of 2936 farmers representing 225,573 acres of various kinds of farming, and employing 6002 laborers under normal conditions.

This means an average of about 80 acres.

Losses in Acreage.—Of the acreage represented, only 16 cases of losses in acreage are reported traceable to a shortage of labor, which total:

85 acres, grain sorghums.

500 acres, cotton and grain.

470 acres, beans.

5 acres, potatoes.

55 acres, vegetables.

20 acres, crop not stated.

Losses in Quantity.—Fifty cases are reported of losses in quantity due to labor shortage, which total:

Fruit

case, 1000 lug boxes of peaches.

1 case, 10 acres peaches—amount not stated.

2 cases, 1414 tons dried peaches.

2 cases, 25 tons dried fruit.

case, 50 tons green fruit.

(Vaca Valley), \$25,000 on dried fruit. (Vaca Valley), \$37,500 on green fruit.

1 case, \$200 worth of grapes.

1 case, 200 boxes of grapes, acreage not stated.

1 case, 15% of grapes.

1 case, 50 boxes of pears.

1 case, 2500 boxes of apples.

Hay

6 cases, 1st cutting on 247 acres of alfalfa.

1 case, 3 cuttings on 40 acres of alfalfa.

1 case, 1 cutting alfalfa, acreage not stated.

1 case, \$5000 loss in alfalfa hay.

1 case, 20 acres alfalfa, amount not stated.

1 case, 40 tons of alfalfa hay.

1 case, 50 tons of hay.

Grain

- 1 case, 10%-acreage not stated.
- 1 case. \$420.
- 2 cases, shattering loss-impossible to estimate.

Field Crops

- 1 case, "considerable" loss in sugar beets.
- 1 case, 15 acres potatoes.
- 1 case, 10% tomatoes.
- 1 case, 5-10% loss in cultivation.
- 1 case, 22 acres corn.

Miscellancous

Loss in shearing sheep.

1000 cords of wood.

Cases where neither acreage nor crop is stated:

6 cases respectively 5%, 10%, 15%, 20%, 25%, 331/4%.

Losses in Quality.—Thirty-two cases are reported in losses in quality due to lack of help. These summarize as:

Fruit

- 5 cases, overripe when picked-amounts not stated.
- 2 cases, 4 tons peaches.
- 1 case, no spraying.
- 1 case, 10% wine grapes.
- 1 case, 10% peaches.
- 1 case, 5-10% of table grapes.

Hay

Several cases, alfalfa too mature.

- 1 case, 1 cutting alfalfa—acreage not stated.
- 1 case, 3 cuttings from 80 acres alfalfa.
- 1 case, 1/3 of 2 cuttings from 20 acres alfalfa.
- 1 case, \$2000 alfalfa hay.
- 1 case, 30 tons alfalfa.
 2 cases, 220 acres alfalfa—amount not stated.
- 1 case, \$350 from 50 acres alfalfa.
- 1 case, \$400 on 80 tons alfalfa.
- 1 case, 50% alfalfa.

Grain

1 case, 1/3 on 50 acres barley.

Field Crops

- 1 case, 10% tomatoes—acreage not stated.
- 2 cases, \$300 beans.
- 1 case, 100 acres onions reduced in quality-amount not stated.

Miscellaneous

- 1 case, "some loss"—no data given.
- 2 cases, with neither crop nor acreage stated, 15%-30%.

REPORTS FROM COUNTY FARM LABOR AGENTS OTHER THAN FARM ADVISORS
These reports cover twelve counties where farm advisers were not available,
representing an acreage of over 500,000 acres devoted principally to fruit, grain,
general farming, alfalfa, hay, beets, seeds, vegetables, beans, potatoes and a
few special crops.

Losses in Acreage.—Only in one instance is any loss in acreage reported, and that one does not state either acreage or amount.

Losses in Quantity.—Six of the twelve agents report no losses in quantity for their counties, two do not offer any statement, while the total losses of the other four comprise:

1 case, "very small."

1 case, "some in grapes."

1 case, 50 tons dried apricots (ascribed to low wage scale).

1 case, 10-25% in grapes and apples.

Losses in Quality.—Only two reports convey any items of loss in this respect, i.e., one case-"much inferior quality in apricots"; the other, first crop alfalfa suffered; no details are given.

REPORTS FROM PRIVATE FIRMS

Seventy-three firms, from a total of 150 asked to report, gave their findings based on the 1917 season. Their holdings, when stated, represented a total of 348,566 acres, ranging in size from 23 to 35,000—an average of 5622 acres. These 73 operators employ a total, roughly estimated, of 4592 laborers.

Loss in Acreage.—Of the 73 firms, 16 did not present any report whatever concerning losses in acreage, while 46 reported no loss. Of the 11 reporting losses in acreage the totals amount to 8773 acres, from a total of 7 cases, to \$120,000 in two additional cases, and two reduced sugar beet acreages in two additional cases, amount not being stated. Crops involved, where stated, besides sugar beets, are rice, corn, beans, tomatoes, and potatoes, all war essentials.

Losses in Quantity.—Of the firms reporting, 26 indicated loss in quantity, 31 stating that no losses in quantity had occurred.

Losses range from "very small" to one firm reporting a loss of \$205,000. Summed up, the total losses of the 73 firms amount to:

Cash losses, 6 cases, estimated at \$237.258.

Sugar beet acreage—2 cases—6800 tons. % losses, 7 cases, estimated at from 10% to 60%. 1 case of pears, 10,000 boxes.

1 case of beans, 1000 sacks.

2 cases of alfalfa hay, 25,050 tons.

1 case of cuttings of alfalfa, 2 cuttings on 1000 acres.

1 case, loss of pigs because of insufficient help to care for sows when farrowing.

1 case, "land not properly worked."

1 case, fresh fruit, 56 tons.

1 case, raisins, 3 tons.

Losses in Quality.—Eighteen firms report loss in quality, 37 firms report no

In seven cases reports show a reduction in quality of 5% to 66%% on fruits, corn, silage, bulbs, and tomatoes.

One thousand three hundred boxes of pears and 30 tons of peaches are reported in another instance.

Four reports state a loss in quality estimated in money at \$13,000.

Two reports show a loss in quality on 11,000 tons of alfalfa.

Ten thousand boxes of pears are reported as having lost in quality.

DETAILS OF INQUIRY INTO LOSSES DUE TO LABOR CONDITIONS OF 1917

To indicate the detail of this inquiry tabulated data is presented in full covering the various investigations into losses resulting from 1917 labor conditions.

DETAILS OF 1917 CROP LOSSES DUE TO INSUFFICIENT OR INEFFICIENT HELP AS REPORTED AT FARM CENTER MEETINGS

County	Center	Acreage decrease	Loss in quantity	Loss in quality
Fresno	Raisin	None	None	None.
	Selma	None	1000 lug boxes peaches, shortage of trays	None.
	Kerman	None	2-3 tons dried fruit, worth \$140 ton	Fruit not hauled at proper time; 15% loss.
	Reedley	None	None	None.
	Fowler	None	2 tons dried peaches	Some sunburned; not tak- en care of soon enough.
	Parlier	None	1 1/2 tons dried peaches; 50 tons green	Some loss; no definite fig- ures could be given.
	Sanger	None	2 tons dried peaches	None.
Glenn	Bayliss	None	None	None.
	Ord	20 A. grain sorghum	7 A. alfalfa, 1 cutting	None.
	Larkin	None	None	1 cutting alfalfa deterior- ated, due to slowness in moving.
	Orland	None	None	None.
Humboldt	Loleta	None	10% in grain	None.
	Bayside	Nono .	None	None.
	Arcata	None	None	30% loss account lack of weeders and care of crop.
	Ferndale	None	None	None.
	Fortuna	None	Three report 33%	None.
	Shively	None	Gribble Bros. loss 25%	Tomatoes, loss 10%.
Imperial	Verde	None	5% loss of harvest through lack of labor	None.
	Eucalyptus	None	None	None.
	Meloland	None	None	None.
	Mesquite Lake	None	None	None.
	Westmoreland	None	About 10%	None.
	Calipatria	About 5%	About 15%	None.
	Magnolia	About 15%	About 20%	None.
	Mt. Signal	None	Cannot get cotton har- vested; if rain or mist comes will lose ½ crop.	None.
	McCabe	None	None	None.
	Seeley	None	None	None.
	South Fern	None	None	None.
Kern		None	40 A. alfalfa, 3 cuttings, loss \$300	80 A. alfalfa, 8 cuttings sold as grazing, \$160; too ripe.
	Edison-Fairfax	5 A. corn	Grapes, \$200; not able to get labor to irrigate	None.
	Rio Bravo	None	1 cutting alfalfa, 45 A., \$450; 1 cutting alfalfa, 20 A., \$200	% of 2 cuttings alfalfa. 20 A., \$133; 30 tons alfalfa laying in shock, \$30.

DETAILS OF 1917 CROP LOSSES DUE TO INSUFFICIENT OR INEFFICIENT HELP AS REPORTED AT FARM CENTER MEETINGS—(Continued)

County Kern	Center . Delano	Acreage decrease 20 A. beans, \$700 20 A. corn, \$600	Loss in quantity 50 tons hay short; laid too long in fields, \$500	Loss in quality 1 ton peaches, \$60.
	Wasco	None	22 A. corn, \$640; 20 A. alfalfa	50 A. alfalfa, \$6-\$7 per A.
	Tehachapi	None	None	Hay discolored owing to lack of labor to get in soon enough; 80 tons at \$5, \$400.
	Rosedale	None	20 tons hay, \$160; loss on harvest hands, \$420	None.
	Arvin	None	None	None.
	Pond	10 A. corn, \$200; 5 A. potatoes, \$250	110 A. alfalfa, 1 cutting lost acount not being able to irrigate, \$990	None.
Madera	Dairvland	None	None: favorable season	None.
	Alpha	20 A.	None; favorable season	None.
	Fairmead	None	None	None.
Merced	. El Nido	None	None	None.
	Le Grand	None	1 crop alfalfa on 20 A.	20 A. alfalfa had to be left few days too long.
	Dos Palos Cottonwood	None 30 A. corn	None Miller & Lux reports loss several hundred acres alfalfa	None. 200 A. alfalfa too ripe.
	Planada	400 A. beans	10 A. peaches; too late	Peaches too ripe.
	Delhi	None	None	8 tons peaches too ripe.
	Amsterdam	None	1 crop alfalfa lost, 30 A.	Alfalfa too mature.
	Stevenson	None	None	None.
	Irwin	50 A. beans	None	None.
	Winton	None	None	None.
	Livingston	None	None	None.
Napa		None	None	None.
кара	Soda Canyon	None	None	None.
	Calistoga	None	None	None.
	Spring Valley	None	None	None.
	Chiles Valley	None	None	1 case grapes too ripe.
	Carnero	None	None	Shortage of fruit trays and cutters for pears.
Nevada	Limekiln	None	Sheep man could not shear sheep at proper time; lost something on fu- ture clip	None.
	Gold Flat	None	50 boxes pears	Beans, \$200; too ripe when picked, rejected.
	Clear Creek	None	Hundreds of tiers of wood uncut for which there is sale	None.
	Chicago Park	None	None	None.
	Penn Vallev	None	200 boxes grapes	None.
	Indian Flat	None	700 cords wood uncut which were planned for	Failed to spray trees.
	Forest Springs	None	None	None.
	Peardale	None	None	None.
	Birchville	None	None	None.

DETAILS OF 1917 CROP LOSSES DUE TO INSUFFICIENT OR INEFFICIENT HELP AS REPORTED AT FARM CENTER MEETINGS—(Continued)

County Center decrease Loss in quantity Loss in quality None	s not l. s too
Lomis Mt. Pleasant None None None Allen None None None Allen None None None None Sheridan None None None Sheridan None None None None Gold Hill None None None Welmar None None None Single fruit Correct States of Considerable loss; shattering of grain States of Considerable loss; shattering of Considerable loss of Considerable loss; shattering of Grain States of Considerable loss; shattering of Grain States of Considerable loss; shattering of Considerable loss of Considerable loss; shattering of Considerable loss of	s not l. s too
Mt. Pleasant Allen None None Allen None None Sheridan None None None Sheridan None None None Sheridan None None None Welmar None None None Welmar None None None Corona None None Planted. 20-25 tons fruit dropping. Perris None Considerable loss; shattering of grain Verring of grain Prultysle None None None None Fruitysle None None None None Little Lake None None None None Little Lake None None None None Cohella None None None None None None None None	s not l. s too
Allen None None None Sheridan None None Sheridan None None None Odd Hill None None None None None None None None	s not l. s too
Sheridan None None None None None None None Non	s not l. s too
Gold Hill Weimar None None None None None None None None	s not l. s too
Welmar None	s not l. s too
Riverside	s not l. s too
Perris None Considerable loss; shattering of grain	s not l. s too
Perris None Considerable loss; shattering of grain Banning None None None None None. Nuevo None None None None None None. Fruitvale None None None None None None. Little Lake None One man had loss due to lack of labor when harvesting fruit Arlington 1 case Unable plant corn None. Cochella None None None 100 A. onions delay planting; bring largie than if plue earlier. \$2000 lost to lack of labor to vest alfalfa at prime. Sacramento Elverta None None None 10% loss of peaches to labor and sho of cars. Galt None None None 10% loss of peaches to labor and sho of cars. Galt None None None None None None None None	l. n too
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Lockeford None \$5000 loss because alfalfa 5-10% table grapes could not be handled at for wine; unable proper time picked soon enoug	
could not be handled at for wine; unable proper time picked soon enoug	
Ripon None None None.	to be
Manteca None 10% tomatoes spoiled None.	
Linden None 40 tons of alfalfa None.	
Farmington None Slight loss, due trouble None. getting cars	
San Bernar- Fontana None None None.	
dino Highlands None None None.	
Chino None None None.	
Daggett None None None.	
San Bernardino None Considerable loss through None. inability to get men to thin sugar beets at proper time	

DETAILS OF 1917 CROP LOSSES DUE TO INSUFFICIENT OR INEFFICIENT HELP AS REPORTED AT FARM CENTER MEETINGS—(Continued)

G		Acreage	V !	T inlian
County	Center	decrease	Loss in quantity	Loss in quality
G D!	Lucerne	None	None	None.
San Diego		None	None	None. None.
	Alpine	None	None	None.
	Jamue Jamecha	None	None	None.
		None	Some shattering of grain; impossible estimate loss	
	Del Mar	None	Unable to get but one bean-cutter; shortage one cutter; loss here	Beans shelled out in field; \$100 bean loss.
	Encinitos	None	None	None.
	Bonsall	None	None	None.
	Fallbrook	None	None	None.
	Escondido	*	None	None. * See footnote.
	Poway	None	8-10 tons dried peaches	14 of 50 A. of barley.
	Lakeside	None	15 A. of potatoes; unable to dig right	None.
	Ramona	None	None	None.
	Julian	None	2500 boxes apples, parti- ally due labor shortage. Hard to get labor for short period of apple harvest	None.
Solano	Soleno	None	None	None.
Stanislaus		None	None	None.
	Claus	None	None	None.
	Patterson	None	None	None.
	Jennings	None	None	None.
	Keyes	None	None	None.
	Denair	None	None	None.
	Hughson	None	None	None.
	Mt. View	None	None	None.
Yolo	Clarksburg	None	None	None.
	West Sacramento	None	None	None.
	Madison	None	None	None.
	Zamora	None	None	None.
	Winters	None	Loss of 10% of \$250,000 dried fruit crop esti- mated, and 15% of green fruit crop, also valued at \$250,000	Considerable fruit over- mature; included in previous estimate.
	Dunnigan	None	None	None.
	Willow Oak	None	None	None.

^{*} Schulte had tomato plants and land. In July offered use of land, plants and water for half; no takers. G. S. Bowler had 35 A. sugar beets thinned but was four men short. Mr. Oaks had plants for 40 A. tomatoes, 15 A. cabbages; no help, no planting.

DETAILS OF LOSSES DUE TO SHORTAGE OF LABOR AS REPORTED BY COUNTY FARM LABOR AGENTS OTHER THAN FARM ADVISORS

County	Loss in acreage	Loss in quantity	Loss in quality
Amador	None	None	None
Del Norte	None	None	None
El Dorado	None	Very small	None
Mendocino	Some in beans	Some in grapes	None
Plumas	None		
San Benito		50 t. dried apricots	Much inferior quality in apricots
San Luis Obispo	None	None	None
Santa Crus	None		
Sierra	None	None	None
Siskiyou	None	. None	None
Sonoma	None	10-25% in grapes and apples	None
Tulare	None	None	First crop alfalfa suffered

DETAILS OF LOSSES DUE TO SHORTAGE OF LABOR AS REPORTED BY PRIVATE FIRMS

No. 1 2	Loss in acreage	Loss in quantity No loss	Loss in quality No loss. 5-10%.
8		No loss	15% in weight on green prunes
4	Could have signed up more acreage had la- bor been in sight.	3314% of loss of 6692 tons beets. 660 A.	66%% of loss, or 13,383 tons 1338 A.
5			
6	13 A. not planted; couldn't hire tractor or teams time.	35 tons pears rotted; delay in transportation. 11 tons pears not cut due to lack labor; 10 tons peaches rotted on ground	1300 boxes pears and 30 tons dried peaches; did not develop. Couldn't plow soon enough ac- count breaking in new man at pumphouse.
7	20 A.	\$1000-\$2000	\$1000-\$2000.
8	None	Part of fifth cutting of alfalfa. Several litters of pigs from covotes; couldn't look after them properly farrowing time	None.
9	None	None	None.
10	None	Trouble getting box shook has extended green fruit season, and will extend raisin season. Packing houses at Fresno running 50% capacity due lack of help and lateness delivery shook boxes	None.
11	None	None .	None.
12	80 A.	Land not properly worked due to scarcity of labor	Only three-quarters acreage was properly worked.
13	40 A.	10% on potato crop; 50% on Holland bulb crop	10% on corn silage; 40% on Holland bulb crop.
14			
15	None	No loss	No loss.
16	None	20% tomatoes	20% tomatoes.
17	None	25 A. corn overrun with weeds; got 4 tons per acre instead of 10 tons.	
18	None	20% grape crop by shrinkage, due to shortage labor	

DETAILS OF LOSSES DUE TO SHORTAGE OF LABOR AS REPORTED BY PRIVATE FIRMS— (Continued)

'		• • •	w
No.		Loss in quantity	Loss in quality
19	None	None	None.
20	None	None	None.
21	None	None	None.
22	None	10,000 boxes pears	10,900 boxes pears as seconds.
23	None	None	None.
24	None	Fair weather alone prevented	None.
		large losses	
25	None	None	None.
26	None	None	None.
27	None	\$258	\$1000.
28	None	4200	42000
29	None	None	None.
30	None	None	None.
31	None	None	None.
		- · -	
32	None	1000 sacks beans; not enough labor to put in second crop promptly and well	None.
33	None	5% fruit dropping	None.
34	20 A. Couldn't get hay	,,	None.
-	baled in time to plant beans.		
35	None	None	None.
36		25,000 tons alfalfa lost, due to lack of labor to irrigate land which stood idle or was fed	11,000 tons of alfalfa fed when other feed was available.
37		which stood late of was 160	
38		Tr	37
		Very small	Very small.
39		AAOO AFOO Walahhaan	
40		\$400-\$500. Neighbors report loss of half of tomato crop	•
41			
42			
43		Small	Small.
44	2500 A. rice, 2500 A. corn	Small, owing to long, favorable, dry season	Small.
45			•
46			
47		No losses so far but liable to be as labor very short	
48	600 A. Couldn't secure		
	Fresno scraper men.		
49	None	50 tons alfalfa; no irrigators	None.
50	None	None	None.
51	3000 A. Preparing bean land \$15,000 gross. 800 A. beets, \$50,000 gross. Interest in tax loss, \$50,000. Preparing tomato land, \$5000.	Defection in bean seed, \$4000: 1 cutting alfalfa on 1200 A., \$2500	160 A. potatoes, \$10,000.
52	None	None	None.
58		Beans, 4000 A., \$120,000 gross; corn, 4000 A., \$60,000 gross; potatoes, beets, etc., \$25,000	Covered under quantity.
54	None	None	None.
55	None	None	None.
56	None	2 crops alfalfa on 1000 A.	Corn, beets, beans.
57	None	831/6% loss on born, beans, beets	
58	None	None	None.
		•	==

DETAILS OF LOSSES DUE TO SHORTAGE OF LABOR AS REPORTED BY PRIVATE FIRMS— (Continued)

No.	Loss in acreage	Loss in quantity	Loss in quality
59	Reduced beet average.	Partial loss 17 A. beets	100 tons overmature alfalfa hay.
60	None	None	None.
61	None	None	None.
62	None	Small loss of beans and citrus	Citrus, some overripe.
63	None	None	None.
64	None	None	None.
65	None	None	None.
66	None	None	None.
67	None	3 tons raisins; lack of labor in curing	Slightly reduced.
68	None	None	None.
69	None	None	None.
70	None	None	None.
71	None	\$1000 fruit loss	\$ 500.
72	None	20% grapes	10% prunes.
73	None	None	None.

Additional Evidences of Losses.—Field observations during the season indicated the occurrence of losses due to lack of sufficient labor. In several instances sugar beet fields suffered from serious weed growth, due to lack of help to cultivate and hoe. During the harvest season, because of unskilled toppers, an appreciable loss resulted from improperly topped beets, conservatively estimated at from 10 to 15 per cent of the crop. A number of Imperial Valley cotton fields were partly abandoned because of lack of men to hoe and thin out the crop. In the deltas weed growth seriously interfered with development of the bean crop in certain fields, and in at least one case caused the abandonment of the crop. Lack of help in certain hay fields tended to delay planting of summer crops, resulting in a lowered quality of the hay and a reduced output. Due to lack of men to pick up sacks, several ranchers had to quit harvesting and use the machine crews to clear the field of sacks. In at least one case the quantity and quality of the asparagus output was seriously reduced. Inability to keep up hay crews resulted in a decreased output of baled straw. Loss of fruit due to inability to get experienced pickers and cutters occurred in a number of instances. The wood output of one ranch alone was reduced 50 per cent because of lack of wood choppers.

On the other hand the evidence proved a far less loss than early spring estimates indicated. Several investigations into reported shortages of labor failed to substantiate the facts as originally given.

At a meeting held November 17 in Fresno by eight County Councils of Defense of San Joaquin Valley the following developed:

Stanislaus County—No losses. No worry about meeting labor another year. Merced County—No losses, but production not up to maximum; labor short. Madera County—A grain county, no serious difficulty in getting men nor nor any great drawbacks to production.

Fresno County—Not especially short of labor but quality not as good.

Kings County—Paper read showing shortage, statements challenged by other delegates from same county.

Tulare County-No shortage this season.

Kern County-No remarkable examples of losses.

San Joaquin—(No representative present.)

Survey by Commission of Immigration and Housing.—When the beet sugar companies of southern California were ready to release about 1700 imported Mexicans for cotton picking in Imperial Valley, in answer to a demand for 5000 men, the Commission of Immigration and Housing through its field men made a farm to farm canvass to ascertain the actual needs. As a result of covering 216 farms, or over half the cotton acreage of the American side, a need was found for 1000 men instead of 5000 as originally claimed, 560 of which the farmers expected to obtain locally without any difficulty.

On December 13, with cotton still being picked, there were numbers of idle men unable to secure employment at various Imperial Valley towns, indicating a surplus of help.

INDICATIONS OF INCREASING LABOR SHORTAGE RESULTING FROM A COMPARISON OF 1917 WITH 1916

The indications used as a measure of an increasing shortage are:

- (a) Payment of higher wages.
- (b) Providing of better living conditions.
- (c) Efficiency of labor.

An investigation of these factors was made a part of the inquiry described on pages 38 to 44. Details are omitted for lack of space, but are on file and available in this office.

In general the records indicate a marked increase in wages, although in some cases wages are still stationary. Where increases have taken place a uniform average of about 40 per cent has occurred.

Very little has been done to improve housing or boarding conditions.

A very few reports show a slight readjustment of hours.

Much complaint of reduced efficiency occurrs, particularly among the large employers. Of the farm centers about one-half report the same efficiency during 1917 as in 1916, while the remaining half, with a few exceptions, report reduced efficiency. Of the large employers the great majority report reduced efficiency. When stated in percentages, 1917 efficiency over 1916 is rated at about 75 per cent by those offering evidence of a reduction in capacity.

Whenever opinions are given, farmers are quite uniform in ascribing the cause to drink, too much money, and too great ease in getting jobs, which combine to make for independence; and the greater use of inexperienced help.

FARM CENTER REPORTS

Wages.—Of the 132 Farm Centers reporting, eighty centers present data covering percentage increase in wages during 1917 over 1916. The increase ranges from 5 to 100 per cent. The average increase is 40 per cent, leaving out eighteen cases where 1916 wages are not stated.

Housing.—The providing of better housing is reported in only five instances. Board.—Providing of better board occurred in but one case.

Efficiency.—Of the 132 farm center meetings reporting it is significant that only one reports better efficiency of labor in 1917 over 1916, while sixty report the same efficiency, and fifty-three report a reduced efficiency, which, in the

fourteen cases where figures are given, ranges from an estimated efficiency of 90 per cent to but 60 per cent, or a general average efficiency of 75 per cent when compared with 1916.

Of the sixty centers reporting the same efficiency the principal counties reporting this condition are Fresno, Glenn, Madera, Napa, Nevada, Placer, Solano, and Yolo.

Counties prominent in reporting less efficiency are Humboldt, Imperial, Kern, Merced, Riverside, San Joaquin, and San Diego.

REPORTS FROM COUNTY FARM LABOR AGENTS OTHER THAN FARM ADVISORS

Wages.—Of ten county agents reporting on this matter nine indicated that wage increases had occurred in 1917 over 1916 ranging from small to 100 per cent, or a general average, as near as can be given, of 40 per cent

Living.—One county agent reports improvement in housing and board; the others do not report on this part or else state "no change" or "already satisfactory."

Efficiency.—Of the nine reports received covering the efficiency of farm labor, two find no difference, five report a reduced efficiency, one finds them more efficient but more discontented, while one finds floating labor more independent.

Reasons advanced for the less efficiency are drink, higher wages apparently paid in other industries, and loss of best men by military draft.

REPORTS FROM PRIVATE FIRMS

A description showing the conduct of this investigation is given on pages 38 to 44. Details are omitted here but are on file, where they can be consulted by anyone wishing to see them.

Wages.—Of the seventy-three private firms reporting, fifty-nine report paying increased wages 1917 over the corresponding period of 1916, ranging, when stated in percentages, from 10 to 100 per cent, or a general average of 40 per cent, which corresponds with the increases noted in the preceding reports.

Better Board .- Four firms report better board.

Better Housing .- Four firms report better housing.

Readjustment of Hours.—Seven firms report shorter hours.

Efficiency.—Thirty-seven firms report a reduction in efficiency of labor ranging, when stated in percentages, from 20 to 66% per cent, or a rough average of 35 per cent. Nine firms complain of labor but do not make specific statements. Seven firms report no change in efficiency. Three reports credit labor with greater efficiency, one primarily to institution of piecework basis.

SEARCHING OUT SUPPLIES OF LABOR

Efforts to develop supplies of labor by various commercial firms and farmers' organizations have brought about some interesting results.

Work of the Beet Sugar Companies.—By far the best organized and executed plan having to do with the importation of labor is that put in operation by the six southern California beet sugar companies. Mexicans, the principal labor available for southern California beet fields, were extremely difficult to get, especially as what labor there was combined in an attempt to hold up wages. Conditions were so bad in August, when the harvest of the crop began, that

the southern California sugar companies combined to import Mexicans from over the border under special agreement with the United States Department of Labor.

A conservative estimate indicates that 1700 Mexicans have been imported from Eagles Pass, El Paso, Douglas, and Nogales, including perhaps three hundred imported independently by the sugar companies north of Tehachapi. The sugar companies' organization paid these men because of its responsibility under the contract, but collected from the growers what each man earned. Most of these men came into California very needy and many of them appeared to have been insufficiently fed. The number along the border ready to come into the states is said to be almost unlimited, this being especially true of the state of Chihuahua.

The cost of importation was high, especially if a man worked his time out and thus earned free round-trip transportation. In the latter case it averaged over \$60 a head. No cash was paid until the laborer had worked out his passage, though shoes, clothing, money orders to Mexico, etc., were furnished as needed and charged to the laborer's account. Some trouble has been encountered by those interested in the importation of Mexicans to make the necessary arrangements on the Mexican side. The importers of these men found it necessary to place guards in the railroad coaches bringing these men to El Paso and elsewhere, in order to prevent desertions which might cancel the entire movement.

Since the form of agreement tends to indicate the attitude of the United States Department of Labor, and prescribes the limitations of importation, a copy is herewith presented in full, since it may prove valuable to any who contemplate importation of labor from this source or under similar auspices.

THIS AGREEMENT, made by the undersigned sugar manufacturing companies optrating in the southern part of the State of California, with the United States of America, WITNESSETH:

THAT WHEREAS, the undersigned desire to import Mexicans from the Republic of Mexico, for employment in the sugar-beet fields of southern California tributary to the factories of the undersigned, and for no other purpose; and

WHEREAS, the undersigned desire to conform in every respect with the regulations prescribed in connection therewith by the Government of the United States.

Now therefore, in consideration of the consent of the United States of America to the importation of such Mexicans, and their exemption from the operation of the illiteracy, head-tax and contract labor provisions of the immigration act of February 15th, 1917, the undersigned jointly and severally undertake and agree with the United States of America that any laborers imported from Mexico pursuant to said plan shall be employed exclusively in agricultural pursuits; that none but healthy, able-bodied aliens will be imported; that transportation shall be advanced by the undersigned for each alien to the place of his employment; that two unmounted unretouched photographs shall be furnished as to each alien; that unless their period of stay in the United States shall be extended by the proper authorities, such aliens so imported will be returned to the border and delivered to the immigration officer or officers at the port where they entered, within six months from the date of the original entry; that if necessary the undersigned will pay the cost of the return of said aliens to such port of entry.

That as soon as said importation begin the undersigned will establish a bureau or department and operate the same continuously up to the expiration of the period during which such aliens are entitled to remain in the United States, for the purpose of at all times keeping in touch with such aliens and reporting their movements, places of employment and names of employer to the proper immigration authorities; that monthly reports will be made on or before

the 15th of each month by such bureau or department to the officers in charge or the immigration service at the port or ports where entry is affected, showing by identification card number the name and location, and character of employment of each alien on the last day of the preceding month. Said reports to be

in duplicate.

The said bureau or department will immediately report all desertions which may occur to the officers in charge at the port or ports of entry, and to the Inspector in charge of United States Immigration Service, Los Angeles, Calif., including in such report all the facts in connection with said desertion, so far as the same can be gathered by said bureau or department, and all the information which said department or bureau can obtain concerning the reason for desertion, the location of the aliens, the nature of his subsequent employment, if any, what steps were taken to prevent his desertion, and what steps are being taken to effect a return of the alien to his work or to the port of entry; that the undersigned will use every reasonable means to prevent such desertion by insisting upon proper housing and feeding and care for the welfare of such aliens, in all cases where such aliens do not elect to house or feed themselves; that they will see that all aliens imported hereunder are paid the scale of wages prevailing for work of similar character to that in which they are engaged in the community where such aliens are employed.

That they will promptly report such aliens as fail to live up to the conditions of their admission, to the nearest immigration officer; that they will endeavor by every proper means, at their own expense, if necessary, to return to the port of entry such aliens as persist in engaging in pursuits other than agricultural, and where such removal to the border is resisted, that they will present the facts

to the nearest immigration officer for appropriate action.

In case of transfer of laborers from one place or employer to another, the said bureau or department of the undersigned, before any such transfer is made, or as soon thereafter as practicable, will fully advise the proper immigration officers at the port of entry of the change made or contemplated, in order that they may have a record of the name and location of the new employer.

That all aliens imported will upon entry be presented to the immigration officer for proper medical and civil inspection, as well as registration; and

Generally, the undersigned undertake that they will in the highest good faith, and to the utmost of their ability, conform to all regulations and requirements imposed by the Government of the United States in this connection.

It is understood that the aliens to be imported as above set out will not. generally speaking, be employed directly by the undersigned, but will from time to time be employed by different persons in the territory tributory to the said factories of the undersigned, for the purpose of harvesting, caring for and delivering sugar beets which the growers are under contract to deliver to the undersigned; and it is further understood that all expense of importing such aliens and of conducting the department or bureau for reporting concerning them, and all other expenses in this connection, except the actual payment of wages to the laborer, is to be at the cost of the undersigned, and not of the

That the bureau or department established by the undersigned, as hereinbefore provided, will at all times during the term for which said aliens are legally entitled to be retained in the United States, constantly keep in touch with said aliens and their employers, from time to time, and furnish the Government of the United States with full and accurate information regarding the employment and conditions of such aliens.

In witness whereor, the undersigned have caused these presents to be executed by their proper officers, thereunto duly authorized, this day of, 1917.

Los Almitos Sugar Company, By	HOLLY SUGAR COMPANY. By	
American Beet Sugar Company. By	SANTA ANA SUGAR COMPANY. By	
Anaheim Sugar Company. By	Southern California Sugar Company By	

OBTAINING HELP FROM ADVERTISING

Conflicting evidence concerning obtaining of help from advertising has been obtained the past season.

Work of the Valley Fruit Growers' Association.—In order to meet the anticipated shortage of labor in the Fresno District, particularly in raisin grapes, the Valley Fruit Growers' Association of Fresno opened and conducted an employment agency. This was continued until August 23rd, when the Public Employment Bureaus of the State of California, fostered in its work by the Valley Association, opened an office.

As a result of its activities a report of the Valley Fruit Growers' Association under date of Semptember 19th, states: "There is an adequate supply of labor to meet all demands, and at present at least 85% of the raisin crop is on the trays." On September 21st, Mr. W. Flanders Setchel, actively engaged in executive duties connected with the association, stated that he thought at least 90% of the muscats were on the trays and that 50% of the Thompson seedless grapes were in the boxes with the rest of the crop on the trays. The only reason that there were any raisin grapes on the vines was because the trays were being used for peaches and not because of a shortage of labor.

The labor need was met by wide publicity of the opportunities which existed in the San Joaquin Valley to make high wages. Through the agency of the Valley Fruit Growers' Association, advertisements were placed in the local papers and in large cities calling attention to the high wages that could be made by piece work in comparison to those being made in town. As a result the association was flooded with inquiries and people began to flock in from all directions. Many families came by automobile and camped out. The work was in the nature of recreation to many people and paid enough to more than meet the expense of the outing.

Through the co-operation of the Bureau of Indian Affairs, Department of the Interior, an order was issued closing the schools on reservations until the harvest season was over. In this way many hundreds of Indian children were secured. Many more Indian adults worked in the harvest this year than ever before, as is shown by Mr. Setchel's report. This report also states that there were many Indians in Mendocino County and Nevada who were not engaged. It was considered that the expense of transportation was too great to permit of bringing in these workers.

Japanese labor contractors in all parts of the state were visited by representatives of the association and extensive advertising in the Japanese language and in Japanese newspapers was carried on. As a result more Japanese worked in the harvest this year than ever before.

Mexican labor came in large numbers, especially in the vicinity of Sanger, where there is a Mexican colony.

Hindus came from contractors at Stockton, returning at the end of the harvest. White labor was the solution of the harvest this year, according to Mr. Setchel. Never before have farmers considered white labor of consequence because they had in mind their experience with the hobo element. This year the publicity concerning what could be made by piece work stimulated white labor to do work formerly done by the orientals, with a result that as high as twelve, thirteen and fourteen dollars per day was made for a period extending over about

three weeks. In the past this kind of work was considered by white men to be beneath them. They preferred straight pay as teamsters on jobs which would not cause them to bend their backs unnecessarily, and stood by while the orientals working in the harvest made three or four times as much by piece work. This year white men have bent their backs and in so doing have given the utmost satisfaction. Mr. Setchel was very optimistic over the white labor proposition and believes that it was due to white labor this year that wages were not boosted by contractors employing foreign labor.

The Valley Fruit Growers' Association is planning a scheme for the registration of laborers in the season of 1918, for the purpose of simplifying the supply of labor for the ensuing years. This plan contemplates the registration of employers who need labor for 1919. Obviously such a plan might well be tried on a larger scale all over the state during the coming season.

Finances for securing of labor by the Valley Fruit Growers' Association have been obtained by subscriptions from members at the rate of five cents an

Work at Blythe.—Cotton growers in the vicinity of Blythe, anticipating trouble in securing sufficient pickers to care for the crop, early instituted an advertising campaign of considerable extent, which resulted in the receipt of twenty to thirty letters asking as to the possibility of employment.

Most of these inquirers wanted their transportation paid, nevertheless up to September 12th a considerable number of people had drifted into Palo Verde Valley for the season.

Unfortunately, the first of the campaign resulted in requests for people at least two weeks in advance of the actual ripening of the crop; hence there was considerable discontent on the part of the arriving pickers. Some, however, were put to work on other jobs to tide them over, but these were less satisfactory to them than cotton picking. As a result of the campaign sufficient pickers were obtained so that when notice was sent to Blythe that a supply of Mexicans was available to help them in their harvest, they replied that they had sufficient pickers.

Work in Imperial Valley.—Imperial Valley farmers in meeting assembled June 30th, agreed to tax themselves 35 cents per bale of cotton and 10 cents per ton of grain sorghum produced in the season of 1917 to provide a fund to be used in attempts to obtain and bring in labor for the harvest season. A county agent was appointed and an active campaign instituted to bring in Mexicans and Texas families.

Due to difficulty in arranging for the collection of dues, a modification of the plan had to be introduced later. Figures are not at hand showing importations. Because of the shortness of its crop Texas offered the logical field and families were imported from there and from Oklahoma for the Imperial Valley cotton picking and corn harvesting season. The number of these families is reported to be about 500.

In November we were advised that the Imperial County supervisors had agreed to levy a tax of a few cents per acre to create a fund for importing and distributing labor on a large scale for the season of 1918.

Experience in Oakland.—As an example of unearthing a potential supply the experience of Mrs. James Hamilton, chairman of the Agricultural Committee of the Oakland unit of the National Defense Council, provides some interesting

data. In answer to a request from an Oakland cannery, after due investigation, and satisfying herself that conditions were satisfactory, Mrs. Hamilton promised to raise at least 100 women for the cannery the following Monday, the conference taking place on Saturday. The only advertisement was a seven-inch news item appearing in the newspapers. All day Sunday Mrs. Hamilton and her assistant received numerous calls and the first seventy were asked to be at the cannery on Monday morning and responded unanimously, so that they forced the regular hands to return to work. Mrs. Hamilton believes that 200 women could be easily employed at a few hour's notice.

The Drive for Hemet Cannery Help.—The California Growers' Association at a cost of \$853, secured 141 people, many of whom were Los Angeles Normal School girls, for their Hemet cannery, 15 of whom disappeared after securing their first meal and night's lodging. A three weeks' campaign was inaugurated, but it is worth noting that only \$15 was spent for newspaper and \$10 for motion picture advertising. The manager of the Los Angeles office believes many more could have been secured. The rest of the fund was used to advance transportation (\$350); to furnish quarters (\$370); while other charges (including two free meals) amounted to \$128, thus advertising and overhead together amounted to about \$153.

Outside of furnishings and transportation the cost per person amounted to but \$1.09 for each individual obtained.

Only about 50% of those reaching Hemet were still on the job one week after arrival. As a general rule, these city women were considered to be about two-thirds efficient, but made not less than \$1.50 on apricots per day when cutting on piece work at 15 cents per box, and canning at 4 cents per tray. The majority were making from \$2 to \$2.50 per day and some \$3 and even \$4, all working 12 hours. The company furnished cots, blankets, and housing in a burned out hotel and in the school houses. They had also provided a teacher for supervising the children of the workers. It was apparent that those who meant business were actually at work and willing to stay.

The Outcome in Riverside.—W. B. Parker, Farm Adviser for Riverside County, made a strong attempt through well placed newspaper articles and editorials to get 100 women and girls over 16 years of age to cut fruit for canneries in his county, including the Hemet Cannery. The gross result of his campaign was only 20 women, 12 of whom were negresses and all of whom frankly admitted that the motive of their response was financial rather than patriotic.

In his newspaper campaign for fruit cutters, Mr. Parker offered 12 cents a box and stated that women or girls of 16 could make over \$2. At least a month's work was offered, with chances that it would continue for a longer period and under the best of conditions. His appeal to patriotism is indicated in his articles: "The nation needs this fruit and we are appealing to the women and girls of Riverside to come forward as a patriotic duty to help preserve this food stuff." Further on: "This is the first opportunity that the women and girls of Riverside have had to do their bit in solving the labor problems in connection with the food supply, which is so important for winning this war for democracy. Are they going to meet it?"

Horst's Idea.—As a successful employer of city dwellers, employed to pick hops in numbers up to 10,000, the point of view of Mr. E. Clemens Horst, of San Francisco, is especially worth while.

As a result of a conference on August 21st it developed that Mr. Horst believes 25,000 city dwellers can be drawn from the bay regions for emergency help in harvest to do that kind of work for which they are fitted. With a season running fifteen days, a car fare expenditure of \$10, and average earnings of \$1.50 or less a day, he has had good results with thousands of these people. He bases his success upon "a profitable outing" idea. He points out that this kind of labor can only be handled by large employers who are willing to furnish proper living conditions, such as beds, water, latrines and stoves, who will provide entertainment and treat the people as equals. By utilizing these simple ideas he has been able to gather people from long distances, the same crowd returning year after year.

He believes that stress should be placed upon the vacation idea, and not upon this methods as a means of making money. Reduced railroad rates can be secured, and it is usual for the employer to retain half of the ticket until the work is done. It need hardly be mentioned that Americans must be kept by themselves, and not work with Asiatics.

Ukiah's Attempts.—In answer to our request for advices concerning attempts to obtain labor for certain bean canneries working on government contracts, Mr. Claude Van Dyke, County Farm Agent for Mendocino County, writes:

"Answering your communication relative to the patriotic appeal to the residents for help with the harvests:

"The campaign was carried on through the local press for several weeks. It was taken up with the different ladies' societies, church organizations, etc., and the public was generally informed of the imperative need of labor in filling government needs for canned beans and other foods.

"The results were quite favorable. Women who had never done outside labor, as well as many who had never done any considerable home work, joined in with much interest. There was practically no loss due to labor shortage.

"The wages paid were slightly advanced over that paid preceding years. The patriotic answer of the people is directly responsible for much assistance."

Result of a Test Survey in San Francisco.—A worker of the Association of Collegiate Alumnae tried out a questionnaire arranged by us to test the available potential supply of city dwellers who might be available for emergency farm work. Results brought in by her from 100 San Francisco families showed as follows:

Twenty homes in a poor district yielded no result.

Forty homes in a comfortable middle class district yielded one lodger, who might be enrolled, but was uncertain.

Forty homes in a district where the families were supported by small regular earnings, were equally unresponsive.

Use of Boy Labor.—Much popular interest centers in the farmers' use of schoolboys and a part of our work consisted in checking up, so far as we were able, the degree of success attending their employment. The use of schoolboys during the summer has been very general and this season's experience has proven them to be a valuable factor in farm activities.

To employ student or boy labor the essential factors are (1st) work that can adequately be performed by this type of labor; (2nd) proper housing and food, including segregation from the typical low type of transient farm labor; (3rd) a wage scale that is adapted to both the type of work and boy labor, piece work being best; (4th) supervision other than agricultural, i.e., a super-

visor who will act as a councilor for the boys and care for their comfort, moral life, etc.

The ideal situation was found to be where the employer feeds the boys and furnished tents, cots or other satisfactory living quarters. However, where larger groups of boys are concentrated in one camp is is sometimes possible for them to furnish their own equipment, cook food, etc.

Much if not all, of the success attending the use of high school students can be ascribed to the proper selection of boys for the work, followed by the employer's ability to handle the boys, wage scale and proper living conditions.

Constant care should be exercised to make sure that the student recognizes the serious nature of the work upon which he is embarking. In a few cases, even when care is exercised, thoughtless students have greatly injured the effectiveness of the work by lightly entering upon farm service and as lightly giving it up.

Some careful system of keeping in touch with the men is exceedingly important. If the confidence of the farmers is to be won and maintained they must have the assurance that they will not find themselves without help just as the busy season is approaching. Every effort must be made to keep the boys steadily at their task. For young students, more especially high school students, some form of direct supervision, probably in camps, seems essential.

Absorption of Child Labor.—About June 20th, Mr. Will C. Wood, Commissioner of Education for Secondary Schools, secured figures from 140 out of the 306 high schools of the state to show the number of boys and girls available for farm work during this summer vacation. None of the Oakland schools responded because they were already closed, likewise the San Francisco schools, save only the Mission High, while figures were also lacking from six of the eighteen big high schools in Los Angeles. Other large schools failing to report were Bakersfield, Modesto, Pasadena, Pomona, Riverside, and San Diego. Reports were received concerning scarcely one-half the high school enrollment of the state. Eleven of the reporting schools, none of them from the large cities, made virtually blank reports. The total enrollment of all the reporting schools was 13,000 boys and 17,000 girls. Two thousand three hundred boys and 1800 girls expected to be employed at home; 3300 boys and 2400 girls were noted as ready to work on farms in their home neighborhood; 2100 boys and 500 girls indicated a readiness to work at a distance from home. Two hundred and sixty-nine men and 149 women teachers volunteered to help in one way or another, as group leaders or camp directors.

July 11th, in connection with hurry calls for 60 more boys from Sonoma and Sacramento Counties, an attempt was made to find high school boys. Efforts to obtain these lads through the high schools of San Francisco, Oakland, Berkeley, San Rafael, Benicia, Stockton, Oakdale, Petaluma, Sacramento, and Marysville, proved fruitless. Only one school could offer any boys, and these were too young to be used. Three or four boys were, with difficulty, secured in Berkeley and San Francisco by phone.

On July 14th, circular letters were sent to 93 other schools to ascertain the status of their lists concerning boys available either for neighborhood, or for work away from home. To the total inquiries made, 93 answers were received, each with monotonous regularity reporting their boys at work almost to the last one, and expecting to stay at work.

The outstanding fact is that high school boys have been absorbed by local demand wherever available and no surplus labor of this nature has been open for other counties.

Sebastopol Berry Fields.—The berry fields of the Sebastopol section drew more heavily upon organized boy labor than any other section, and during the season used fully 400 youngsters of upper grammar grades in addition to its local supply.

We were much interested in seeing how matters turned out, and several trips were made by representatives of this office into the field. After the season was over, thanks to the courtesy of the leaders, we were permitted access to the records of the various camps, and offer certain findings of a rather striking nature.

The length of the season depends upon the weather, but, roughly, runs from the middle of May to about the first of July for loganberries, and from about the first of July to about September 1st for blackberries.

Tne principal camps were:

- 1. A camp of 158 from the Boys' and Girls' Aid Society, San Francisco, located on the Barlow Ranch for twelve weeks, ending about September 1st.
- 2. The Plymouth Center Camp from Oakland, starting with members under direction of Mr. W. D. MacDonald, assigned to the Kinley Ranch, worked there from June 6th to July 20th.
- 3. Fifty-four Oakland Boy Scouts, in charge of Mr. Henry Raphael, working for Mr. Lee Maddox, remained 38 days, beginning about June 12th.
- 4. Twenty-eight Berkeley Boy Scouts encamped on the Gold Ridge Orchard Company's lands and working for them, in charge of Mr. Percy R. M. Jenkins, remained in the field from June 14th to September 1st.
- 5. Twenty-two children from the People's Place, working for the Fisher Ranch under direction of Miss Marion Adams, picked from June 9th to about July 21st.

Hours, Earnings and Conditions.—The Boys' and Girls' Aid Society in San Francisco has established a camp every year for many years in the Sebastopol berry district. This district has come to depend upon the large annual influx from the society. A number of the boys, being feeble minded or crippled, were only partially efficient. The working day was eight hours, farmers furnishing transportation whenever the work was more than one mile from camp. The society receives boys on commitment from the courts, and does not pretend to maintain its camp on a commercial basis. This summer, working twelve weeks, eight hours per day, they earned on an average about \$33 gross each for the season. Individual earnings range from \$18 to \$90.

The Plymouth Center boys, working on an average from eight to eight and a half hours per day, carned on an average per boy \$.422 per day. The daily expense for board at the Plymouth Center Camp on the Kinley ranch at Sebastopol, was 31 cents, though had all the boys paid up it would have cost about 28 cents per boy. Seventeen boys, or about 30% of the whole camp, failed to make expenses, with an average loss of \$4.46, ranging from 10 cents to \$8.93. The camp ran 46 days, 57 boys present in all; of whom 20 stayed throughout, 21 from 38 to 45 days, and 16, 37 days or less. The boys were reported to have satisfied their employers, although one or two parents were very much dissatisfied with the earnings of their own sons.

Camp Director Henry Raphael of the Boys Scouts working for Maddox reported that the outing was a complete success from the point of view from which it was intended, namely, that of providing an outing for the boys, but the net earnings of 57 boys for the season were only \$90.76. The boys were charged with \$43.76 worth of kitchen utensils, hardware and medical supplies, so that the actual ret earnings were only \$47.

Fifty-seven boys started camp, of which 32 were present from the beginning to the end. Of the 32 the earning soft embods has done the plan of payment, i.e., one cent for every cup and four cents for every tray of berries, \$5 per day for camp directors and tents, tables, stoves and latrines furnished by the rancher, varied from \$6.40 to \$22.52, or an average earning of \$14.64. On several occasions the price paid the boys was increased temporarily 25% to encourage them. Moneys turned over to the boys as figured on five weeks' and three days' work, consisted of everything they earned above \$14.25, except in the case of the boys who came after the camp began.

Money brought home by the boys on this basis ranged from 12 cents to \$8.27. Boys worked on an average 10½ hours in the field. It may be mentioned in passing that the board was not extensive in quantity, since the camp expenses for meat, fish, groceries, bread and pastry amounted to only \$381.49.

Of the 22 People's Place boys and girls taken out by Miss Marion Adams into the Sebastopol berry field, 18 were in camp three weeks or over, nine being present the entire six weeks. Gross earnings of the 18 ranged from \$6.95 to \$30.33, with an average of \$11.82. Deducting board, at rate of \$11 for six weeks, the net earnings were from \$1.84 to \$19.33, or an average of \$2.36 for three to six weeks' work.

It is interesting to note that the ages of these "children" ranged from 11½ years to 25 years, while 14 of the 18 were from 12 years to 14 years of age, inclusive.

The nine who remained the entire six weeks made an average net earning of \$3.73, ranging from \$1.84 to \$19.33, to compensate them for their six weeks' work.

Based upon 1917 experiences it is concluded:

- 1st. At wages which the industry feels it can afford to pay, boys cannot average more than 75 cents to 80 cents a day of eight hours, many boys making less than this sum, of which 50 cents a day must go for camp expenses. The balance left to the boy after paying transportation is nil or negligible.
- 2nd. This work is justified only as a means of financing an outing for the youngsters.
 - 3rd. All the Sebastopol camps were in the hands of good supervisors.
 - 4th. The fare in some instances was scanty.
- 5th. Work of the boys is considered by all the employers, except one, to be highly satisfactory.
- 6th. Impression of most supervisors is that the experience is worth repeating for the good of the boys.

Report of Exploiting Boys.—A report reaching the office that less than usual wages were being paid in the berry fields was found to be without fact. Rather the reverse was true, i.e., a higher rate for this year's picking.

After a trip to the fields, Freeborn says: "The Gold Ridge Orchard Company, one of the largest of the Sebastopol berry growing concerns, is paying

last year's rate for picking plus one-third of all net increase in receipts the company is able to secure over that of 1916.

"Picking costs are considered to be one-third of the total costs. Newton Kinley is paying the same as last year plus all camp equipment and \$2.50 per diem to each of the two Boy Scout supervisors. The same applies to Lee Maddox's place.

"The 1916 rate was one cent a basket, six to the draw, or two cents a basket, two to a draw. Some growers paid a bonus of one-half and one cent per draw to those who stayed through the campaign."

Antioch Asparagus Fields.—In co-operation with Mr. W. E. Meek of Antioch, 24 Berkeley High School students were sent to Bradford Island—a dusty peat island surrounded by levee—in the Stockton delta, to assist in harvesting the asparagus crop. The boys left on May 11th under agreement to stay until June 20th.

One boy was compelled to leave on account of sickness shortly after the work started, six left at odd times from May 14th to June 10th, one was discharged for unsatisfactory service, ten quit June 10th and six remained until the end of the work.

Criticism may rightly be directed against some of the boys who, failing to possess a true sense of individual responsibility toward the work, withdrew before the end of the season or did not put in a fair eight-hour day.

Special and satisfactory camp facilities in the way of tents, showers and cook-house were provided by Mr. Meek in accordance with requirements of the State Immigration and Housing Commission and under the personal direction of one of their inspectors, Mr. E. A. Brown. A representative from the Berkeley High School stayed continually with the boys to watch over their general welfare.

As to efficiency, when working side by side with experienced help, the high school boys on an average cut 50% as much hour for hour, while the best one-third cut 70% as much hour for hour, eight hours constituting a full day for the boys, as against eleven hours for the regular help.

The boys had certain grounds for complaint from their standpoint in the lack of variety of fare, although the food was fully as good and in some respects better than the average California ranch furnishes. Then, the daily earnings were not as high as the boys had reason to expect. This caused considerable dissatisfaction. Working on a piece basis the average earnings, from which 50 cents per days was deducted for board, gave during the period, when the majority of the boys were employed, i.e., every day from May 11th to June 10th, as follows:

Average earning per day before board was deducted for all boys, about 91 cents.

Average earning per day after board was deducted for all boys, about 41 cents.

Total number man days employed, 591 man days of eight hours.

Total number man days not working, 671/2 man days of eight hours.

Percentage of days boys laid off, one-half and full days, 11%.

For best one-third:

Average earnings per day before board was deducted, \$1.13.

Average earnings per day after board was deducted, 63 cents.

After June 10th the rate of pay was increased about 50%.

High school boys were not a success in the asparagus fields, because the work is of a kind and under field conditions such that boys are not able to earn enough to compensate them for the amount of effort demanded.

Vorden General Ranch Work.—About June 8th a request for nine high school boys was filled by us for Mr. M. C. C. Van Loben Sels of Vorden. These boys were employed for general farm work—hoeing beans, clearing land, digging ditch, irrigating, levee, building fence. All the boys stayed with the work in accordance with their original agreement.

No resident representative was with them, regular inspection trips being made from this office. As to the way things worked out, I quote from a letter received from the owner in which he asks for 15 additional boys and said: "We are very well pleased with the boys we have and hope you will be as successful with the other selection." Unsolicited statements were sent in by two of the boys telling how well satisfied they were.

Mr. Van Loben Sels considers the experiment with these boys a great success and emphasized particularly the qualities of the "city boys" with whom he has dealt. It must be remembered that Mr. Van Loben Sels is an unusual man and offers unusual conditions of work. One of his chief points is that boys of high school age must not be put at heavy lifting, such as loading hay, bucking sacked grain, or handling heavy crates and lug boxes.

Fresno Fruit Work.—Without an exception reports secured in an investigation of labor conditions in Fresno County the last of September indicated the character of work done by school boys in the harvest fields was favorable.

The Y. M. C. A. at Fresno advertised for boys to do farm work and established a camp at the Sanger Y. M. C. A. about September 1st, under the supervision of Mr. Neal Locke, a Y. M. C. A. secretary. There was an average of 25 boys at this camp, ranging from 15 to 18 years of age. Younger boys could be had in large numbers, but it was not considered that they could do satisfactory work. Of all boys sent to Sanger, only five were returned on account of laziness or bad habits.

The camp, which was situated on the grounds of the Sanger Y. M. C. A., was established in response to a request from growers in this vicinity who helped to bear the expense of establishing the camp. The Y. M. C. A. secretary looked after the welfare of the boys, lined up jobs for them and had general supervision over their work. Board was charged at the rate of \$5 a week. Lunches were taken out to the boys. The boys either went to work on bicycles, or were called for by farmers.

Very few of the Fresno boys were in the Y. M. C. A. camps, most of them being placed by the Valley Fruit Growers' Association, an estimate indicating that from 800 to 900 were sent out in this way. No complaints regarding the work of these boys were turned in by the growers.

Earnings obtained in harvesting crops in the vicinity of Fresno has resulted in one boy from Bakersfield making from \$4.50 to \$5 per day picking grapes by piece work. He received three cents per tray for muscats and two and one-half cents for Thompson seedless and Sultanas. He stated that he could have had plenty of work at Bakersfield on ranches at \$2.50 per day, but considered he could make more money at piece work. Most boys have been making from \$3 to \$4 a day on piece work. The average boy can easily pick 100 trays of grapes a day. Some boys work by the day, getting from \$2.50 to \$3. The lowest wage which had been made, as far as could be ascertained, was that

obtained by picking peaches. One boy made \$14 per day picking peaches at five cents a box, even though he complained of the peaches being small and covered with red spiders.

Additional Experiences with School Children.—At the Sunlit Cannery in West Berkeley, for the week ending July 16th, 23 boys, working full time, earned \$168.26, with an average of \$7.31½ per week. The working day was eight hours. The lowest earning was \$6.24, the highest \$8.40. Fifteen of these boys were on a 16 cents per hour scale, eight of them on a 17½-cent scale. The ages of these boys ranged from 12 to 15, as follows: 12 years old, 1; 13 years old, 4; 14 years old, 9; and 15 years old, 9. No relation is apparent between the age of the boy and whether he worked at 16 cents or 17½ cents per hour. Four boys, one 17 years old and three 18 years old, worked ten hours per day, earning this same week \$56.05, or an average of \$14.01 per boy. The lowest earning was \$11.90; the highest \$15 for these four boys.

At the same cannery 21 girls working eight hours per day earned for this same week, working full time, \$124.33. The average earning was \$5.92. The range was from \$3.97 to \$12.55. These girls worked at piece rates. The range of ages is shown as follows: 12 years, 6; 13 years, 4; 14 years, 4; 15 years, 3; 16 years, 2; and 17 years, 2.

T. S. Caldwell, Y. M. C. A. camp director of 93 boys, mostly from Oakland high schools, at Sunnyvale, Santa Clara County, reported at the end of July that 100 more boys could be put to work immediately in that neighborhood, that prejudice against such boys had been completely removed by the success of his camp and that farmers were begging for more of them.

Children, young and old, and from any sources have been employed successfully in picking up prunes and walnuts, and seem to be preferable in many cases to the adult whites.

In the Alameda cherry district city boys were reported to be doing fairly satisfactory work, though requiring rather close watching lest they pick too much green fruit. Strength to carry a ladder is essential to doing this work.

During the sugar beet thinning season the Los Alamitos Sugar Company at Los Alamitos used school boys from the vicinity to assist in thinning the crop. They were not held to any given amount of work but paid so much a row, depending upon the length of the row. The results were considered successful, but constant supervision was found necessary, a drawback to extensive use of this class of labor.

Mr. William Begier, San Leandro cherry grower, in June began paying ten boys \$1.50 per ten-hour day, and advanced them to \$1.75 as fast as justifiable. These boys went back and forth from Hayward to East Oakland every day. On July 2nd he reported that the ten boys picking berries for him were so satisfactory that he expected to put 20 boys to work on apricots at \$1.50 and \$2 per ten-hour day, not including board, as the boys rode to and from their homes in Oakland.

Santa Barbara High School boys were kept working in the lima beans and melons of Ventura County from June to September with good results. Local authorities state that the boys can be used to advantage picking up walnuts, but the season (September 15th to November 15th) seriously interferes with school work.

Forty-five boys employed for a few days thinning peaches near Fresno, gave an average efficiency rated at 90%, with best one-third 100% efficient.

Four boys were discharged; the rest stayed until the end of the job, four days, being paid \$2.25 per day of ten hours.

The Kirkman Nurseries of Fresno used ten boys tying up shipments of plants. They reported them 100% efficient after a month's work and at the time of our visit none had quit or been fired.

Closing Schools.—School authorities in San Francisco, Alameda, Oakland, and Berkeley were interviewed during the latter part of July in the belief that a considerable number of high school boys now at work on the farms should be allowed to remain at work during August without endangering their school standing. The attitudes of these people differed in detail, but they all agreed to co-operate to the utmost of their ability, especially in the matter of facilitating the boys' efforts to regain standing upon their return to school. They also showed in common a readiness to allow boys to be recruited for necessary farm work after the schools should have opened, upon emergency being shown.

This office has caused much attention to be given to the inevitable clash between California crop harvest and preserving (in canneries, etc.) and the early opening of the bay schools. These schools are nearly all in full swing by the first of August. We have gotten some of the most important school boards interested in a revision of their vacation dates in the interest of 1918 crop seasons. To bring this about would materially lessen the labor difficulties of many farmers and canneries of the bay region.

Senate Bill No. 1202, chapter 192, empowers the State Board of Education to close any or every school in the state, or to postpone its opening as a war emergency measure, in order that students may be engaged in the saving of crops, provided only that no school year shall contain less than six months. The act further provides that no school district shall, because of such closing, lose any portion of its revenue and that the teachers concerned shall be paid their full salaries and may be required to go upon ranches with their pupils as group leaders or camp directors.

Correspondence with the Superintendent of Public Instruction at Sacramento indicates a considerable lack of co-operation between the different central school authorities of the state in respect to the law passed authorizing the State Board of Education to close any school temporarily as a war emergency measure. As it may yet be desirable to invoke this law, it should seem that an effort should be made to get the machinery for operating the law into good working order. This probably has not yet been done. For example, this office is still inquiring how the law could be invoked upon a sudden necessity with the State Board of Education not in session.

As a matter of general interest rulings regarding the closing of schools to permit pupils to aid in farm work is of interest to all working to relieve the farm labor shortage.

The Attorney General's office for the State of California was asked by us to render a decision concerning the closing of schools. The findings are deemed to be of sufficient interest to give in full.

"I have your communication of even date wherein you ask whether the local school authorities may close their schools to some of the pupils in order to permit them to engage in agricultural work and at the same time maintain the schools for other pupils who are not so engaged. You also ask whether, if such action is taken, the provisions of the Child Labor Law requiring permits to work and age and schooling certificates will apply. You also ask whether such action would affect the revenues of the school districts in so far as the appor-

tionment of state school funds upon the basis of average daily attendance is concerned.

"Local school authorities may, under the provisions of section 10 of the Political Code, declare holidays in the public schools under their jurisdiction when good reason exists therefor. A holiday so declared would, in all ordinary cases, deprive the school of the apportionment of state moneys on the basis of average daily attendance during the period in which the schools are so closed. In this connection your attention is directed to the provisions of subdivision 5 of section 1858 of the Political Code, which covers the matter of apportioning state school funds in school districts maintaining more than one school where a school is closed for a portion of the term. This amendment, which became effective on July 30th of this year, modifies any former construction which has been placed upon the power of local school authorities (in so far as a district which maintains more than one school is concerned) relating to the closing of schools for emergency purposes and the apportionment of the state school moneys during such periods.

"The Child Labor Law requires permits to work for minors of fourteen years of age who have completed the prescribed grammar school course and authorizes permits to work to minors of fourteen years of age who have not completed such course upon the showing that their labor is necessary to the support of a parent or guardian or of the minor. An age and schooling certificate may be issued to minors of fifteen years of age who have completed the grammar school course or who are attending night school, and a vacation permit may be issued to minors between twelve and fifteen years of age during the regular vacation of the public schools, but as to agricultural work no such vacation permit is necessary. It would seem therefore, that a declaration of a period of holidays by the local school authorities would not aid the situation in so far as the requirement of these various permits is concerned.

"Your attention, however, is called to the provisions of chapter 192 of the laws of 1917, effective May 5, 1917, reading, in part, as follows:

"'During the continuance of a state of war between the United States of America and any foreign power, the state board of education, with the approval of the governor, shall have power, whenever in the opinion of a majority of its members such step is necessary for the planting or harvesting of crops or for other agricultural or horticultural purposes and is for the welfare of the state, to make an order closing, for such time as may be specified therein, any or all educational institutions supported wholly or in part by the state, or any grade or class thereof.'

"This same act provides that whenever any educational institution is so closed the salary of the teachers regularly employed therein shall be paid according to the contracts of employment and that such action shall not in any manner affect the amount of money apportioned to any school district during any school year.

"Thus the legislature has committed to the State Board of Education the power to close any of the schools in the state in cases of emergency such as that suggested by you, and when this action is taken by the State Board the local school authorities should close the schools or any grades or classes thereof within their jurisdiction. If, therefore, the State Board of Education deems that such an emergency exists at this time it may so declare by resolution and the local authorities should close the schools under their jurisdiction or any class or grade thereof, but, at the same time, may continue to give instruction therein to such pupils as may desire to continue their school studies. Though attendance upon schools so closed in this manner may be purely voluntary there can be no legal objection to this course inasmuch as the teachers are paid their regular salaries even if no service is rendered and the school receives its full quota of the state apportionment irrespective of the average daily attendance.

"If the course outlined in chapter 192 of Laws of 1917 is adopted then the provisions of the Child Labor Law requiring permits to work and age and schooling certificates will not apply during the period when the schools are closed for emergency purposes in accordance with the terms of that act."

BETTER WAYS OF BRINGING EMPLOYEE AND EMPLOYER TOGETHER

The average farm laborer is only fairly well posted concerning labor needs. When he wants a job he goes to the locality where he desires work or where he thinks work is to be had. Each locality has some place where labor "hangs out," and to this place the employer experienced in getting help goes and gets his men. Some laborers are obtained through representatives who handle all business details as the so-called "labor contractor" of the Japanese and Hindus, or the more loosely connected "mayordomo" of the Mexicans. tractor is fully recognized by both employer and employee—the employer paying a fee for all men he obtains through this source. An unofficial go-between exists when Portuguese, Greeks, Italians, Swiss and similar classes are approached. Being gregarious, these men are usually located at some boarding house and arrangements between employee and employer perfected through the agency of the boarding house keeper. Other classes of labor as Americans, English and Scandinavians, conduct their negotiations without the use of an intermediary. Such men when out of employment can usually be located at some central point where they tend to congregate, as at some saloon, or boarding house, or eigar stand, or pool room, or by inquiring at livery stables, private, state, or federal employment agencies.

Moving around a good deal and coming into frequent contact with one another, the average itinerant worker is conversant with existing conditions. Not only does he know the conditions prevailing on a given ranch, as hours, wages, kind of work, type of foreman, and living conditions, but he is keenly alive to any uneasiness concerning a shortage of labor, and awake to the possibilities of an increase in wages. Moreover, the average worker aims to enjoy life. He goes to the redwoods, in the high Sierras, and to the coast during the heat of summer, he travels to southern California for the rainy season, and he picks and chooses as best he may.

Carson Cook of the Rindge interests thinks a remedy for the present labor shortage is to be found in the organization of the industrial army under state control, the individuals and groups comprising it to be guaranteed a decent living wage, working or idle, and to be handled and moved about systematically so as to obviate conditions and shortages, relieve employer of anxiety and keep every individual at work the greatest possible proportion of the year. The scheme implies securing for laborers all that they could reasonably demand in the way of decent living conditions. One important advantage of it would be to put the chronic loafer to work.

Frank Swett of Martinez advocates that all persons wanting labor should inform the postmasters to that effect and put notices in the postoffice. These notices could also be put in the principal store in town. Word of this practice would soon pass around among strangers and they would get a definite idea of the jobs known and in fact to depend on answers which shall cover the majority of people they encounter in their search for work.

Mr. Maas, in charge of the Fresno State Employment Bureau, gave it as his opinion that much of the trouble experienced with farmers in getting help is due to the fact that they expect to get it as soon as they apply. He thought, too, that men were given poor treatment by many growers. He points out that concerns like the American Seedless Raisin Company and Kearney Ranch, which have good accommodations, experienced little trouble in getting men.

Observations in employment bureaus, both in Los Angeles and San Francisco, show that there are probably hundreds of able-bodied men in each place who will not work, but rather want a particular job at a particular wage, or else certain particular conditions of work. The notices on blackboards seem to have little effect in securing men, the practice being for the clerk to call out jobs and wages during frequent intervals and inviting the crowd to come and talk them over. The men want first-hand information. Virtually no one will consider a job where he has to pay over \$1.50 for transportation. Los Angeles employment agents say that they have known men to pay the agency charges in advance out of gold pieces, showing that large numbers can afford to wait and pick their jobs.

The manager of a prominent San Francisco private employment agency reported in September that there were six hundred unemployed men every day in the different employment agencies in San Francisco, a large proportion of whom would not work on any kind of a job. He said that labor was short everywhere but largely because of its disinclination to work. It may be suggested that this opinion represents the existence of a staple class of unemployed and of large numbers of men able to wait till they meet a job of their liking. A short time previously a contractor ordered ten men for state highway work at \$4.00 a day without board. At these wages the agency charged with obtaining the men thought it could get them at once, but it took two days of constant work. Most of the men approached said the work was too hard. One quickly finds out in employment agency lobbies that a great many men will loaf a long time before they tackle a job involving much muscular effort.

ANTI-LOAFING OR VAGRANCY LAWS

Inquiry into the present outcome in states having anti-loafing laws indicate a beneficial moral effect of such legislation and opens the way to consideration of its use in California. Some doubt is expressed as to the constitutionality and reports following somewhat more extended trials are desirable from states now utilizing this means of increasing the labor supply.

Maryland and Wisconsin have passed recent laws aiming to bring about more extensive occupation in profitable work for habitual loafers.

The Maryland Law.—With certain minor exceptions (as students and those out on strike) the Maryland law vests in the governor, as a war measure, power to compel the registration of every able-bodied male between the ages of eighteen and fifty, and insist on regular employment in a lawful and useful manner.

Provision is made for a Compulsory Work Bureau to assist the governor, their primary duties being to assist in finding evaders from registration and to find employment for the unemployed in agriculture, cannery, or state, county, and Baltimore city road and street work.

Details of wage determination, machinery for carrying out the intent of the law and penalties are fully provided.

The Wisconsin Law (Huber Law).—Wisconsin Statute, Section 697c, generally known as the Huber Law, provides that every male person over sixteen years of age who shall be convicted by any court or magistrate on the charge of vagrancy, vagabondage, petty larceny, drunkenness, or disorderly conduct, shall be punished by imprisonment in the workhouse or in the county jail at hard manual labor.

The law also states that it is the absolute duty of the sheriff to see that such persons are so employed, and to procure employment for them, and that for failure to do so the sheriff is subject to a fine of one hundred dollars for the first offense and removal from office for the second offense.

Under the provisions of this section, any place within the county where prisoners may be employed is made a part of the county jail, and while employed under the contracts of employment so made by the sheriff such prisoners are constructively within the custody of the sheriff. For refusing or neglecting to work, prisoners are subject to punishment by solitary confinement on bread and water for a period of ten days, and are subject to a fine of not more than five hundred dollars or by imprisonment in the state prison or county jail for not more than one year for escaping or attempting to escape, while so employed. For faithful performing of duties assigned to them under such contracts of employment, prisoners are entitled to a reduction of one-fourth of the time of their sentence.

EMPLOYERS' RECOMMENDATIONS FOR 1918

Farmers' recommendations, collected from Farm Center meetings, from County Farm Labor Agents others than Farm Advisors, and from private firms, details of which may be consulted in this office, have been compiled and analyzed. They are especially interesting in showing the wide range of opinions possessed by farmers as to what best constitutes the solution of the farm labor problem.

Analysis and Summary.—In general the following half dozen farmers' recommendations stand foremost, in order of most frequent repetition:

Import labor, most suggestions being in favor (1st) of Chinese or Orientals, (2nd) Mexicans.

Close saloons.

Practice bona fide exemption of farm labor from military draft.

Develop potential home supplies of labor.

Provide better distribution and utilization of present labor supplies.

Promote anti-vagrancy laws.

Conscript labor.

As may be expected, the farm advisors reporting the results of 132 farm center meetings offer a great variety of farmers' suggestions having to do with bettering the 1918 season. Of those occurring with sufficient emphasis to be outstanding, the following are significant. The figure in brackets indicates the times a given recommendation is made.

Close saloons. [19]
Practice bona fide exemption for draft. [13]
Utilize potential supplies, i.e., boys, women, and city dwellers. [12]
Import Mexicans. [10]
Conscript labor. [9]
Distribute and utilize present supply to better advantage. [7]
Force loafers to work. [5]
Exchange labor in communities. [4]
Increase farming efficiency. [3]
Provide better living quarters. [3]
Reduce or suspend highway and municipal work. [3]
Reorganize public employment offices. [2]
Provide plan for purchase of homes by workmen. [2]

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Import foreign labor. [2]
Import Chinese. [2]
Furnish transportation. [1]
Bring labor into the homes. [1]
Plant crops of low labor needs. [1]
Pay higher wages. [1]
Use German prisoners. [1]
Pay for overtime, nine-hour day basis. [1]
Prohibit manufacture of non-essentials. [1]
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Of the seven County Farm Labor Agents other than Farm Advisors reporting farmers' recommendations, the following stand out (figures in brackets indicating number of times opinion is advanced):

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Proper exercise of selective draft. [3]
Anti-loafing or conscription laws. [1]
Importation of Chinese. [1]
Prohibition. [1]
Standardize wages. [1]
Better use of high school students [1]
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Sixty-two of the seventy-three firms supplying us with data concerning their 1917 labor experiences, offer suggestions for 1918, which summarize into groups, taus:

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Orientals. [6]
Not specified. [4]
Mexicans. [3]

Close saloons. [3]

Close saloons. [16]
Exempt bona fide or skilled farm labor from military draft. [15]
Develop potential supplies as women, children, etc. [8]
Provide anti-loafing regulations. [6]
Conscript labor. [6]
Readjust school vacations. [3]
Exchange labor between farmers. [2]
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And a single recommendation in favor of:

Standardize wages. [2]

Provide better living conditions. [2]

Import labor. [30]

Chinese. [17]

Using labor saving machines.
Suppressing I. W. W.'s.
Forcing labor to work at a minimum wage.
Standardizing prices for essential farm products.
Bringing about better personal relations with labor.
Surveying situation to determine needs.
Substituting crops of low labor requirements.
Discontinuing taking of best men for farm advisors.

EFFECT OF 1917 LABOR CONDITIONS ON 1918 CROPS AND INDUSTRIES

The following summaries* present farmers' opinions as derived from the investigations covered on pages 38 to 44 of this report, concerning effect of the past season's labor conditions upon next season's crops and industries. They are obtained from:

- (a) Farm Center meetings held in November.
- (b) County Farm Labor Agents other than Farm Advisors.
- (c) Private firms.

Analysis and Summary.—In general the farmers represented at the Farm Center meetings mostly look for no effect, those anticipating decreased acreage being about offset by those who look for an actual increase. Of the County Farm Labor Agents other than Farm Advisors indications are for a reduction in acreage. Of the seventy-three firms reporting the majority of those passing upon this matter look for a decrease. The total evidence indicates that so far as farmers' opinions are concerned, as represented here, the tendency is toward a slight reduction in acreage.

Of the 132 Farm Center November meetings reporting on this matter, a summary indicates that:

76 reports think there will be no effect on acreage.

23 reports look for an increased acreage.

29 reports expect a decrease in production.

2 reports show substitution of tenants for owners.

2 reports find it too early to predict.

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Estimates of probable decreases are too indefinite to summarize. They can be consulted in the complete tables.

Of the seven County Farm Labor Agents other than Farm Advisors reporting on this matter two report no apparent effect; four look for a reduction, while one looks for an increase.

Of the seventy-three firms reporting concerning their labor experiences, forty-eight report an influence on the 1918 crops, thus:

An increase in acreage, 3 cases. No change in acreage, 17 cases. A decrease in acreage, 26 cases. Will lease lands, 2 cases.

Increases consist in substitution of pasture, stock and grain for crops of higher labor demands. Two ranchers expect somewhat of an increase in their field acreage. One man is to put in forty acres of orchard.

Industries, where named, influenced by decreased acreage, are sugar beets, potatoes, seed, nursery, dairy, swine, hay, corn, beans and new alfalfa.

^{*} Details are on file and may be consulted in this office.

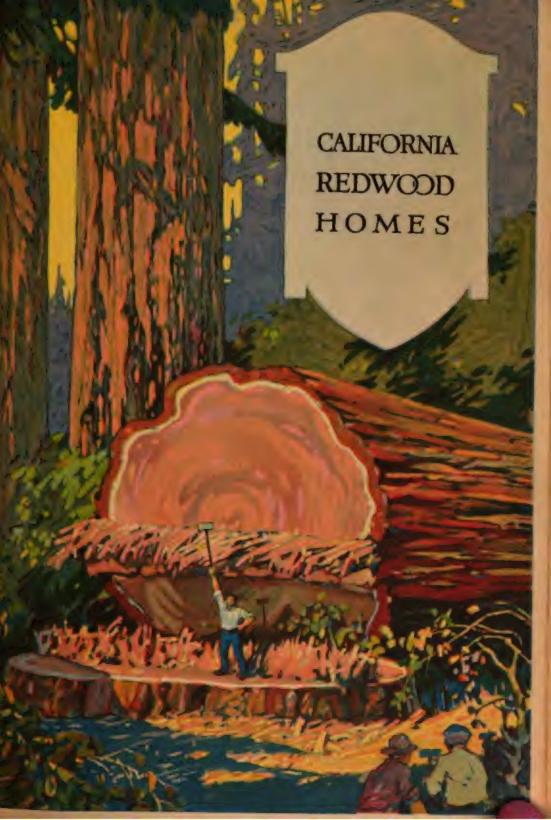
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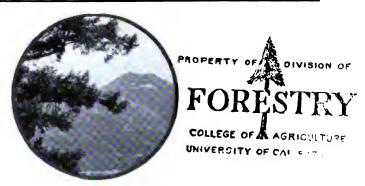
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1902.	Report of the Agricultural Experiment Station for 1898-1901.
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1908.	Report of the Agricultural Experiment Station for 1901-03.
1904.	Twenty-second Report of the Agricultural Experiment Station for 1903-04.
1914.	Report of the College of Agriculture and the Agricultural Experiment Station.
1915.	Report of the College of Agriculture and the Agricultural Experiment Station.
1916.	Report of the College of Agriculture and the Agricultural Experiment Station.
1917.	Report of the College of Agriculture and the Agricultural Experiment Station.

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The Redwoods were born with the Christian Saviour

EDWOOD is lumber from the "big trees" of California—the Eighth Wonder of the World. Scientists call them Sequoia sempervirens, which, when translated into our every-day tongue, means "Sequoia ever-living." Sequoia is an Indian name; the name of a chief of great power and influence among his people. It was natural, therefore, for the Indians to name the giant trees after their most powerful chief.

They are wonderful trees. Their living power is without peer among perishable plant and animal life. The secret of their great age is resistance to rot and fire, and practical immunity to the attack of insect life and fungus growth so destructive to most other kinds of wood. In the forests, the Redwoods have fought decay and fire down the sweep of many centuries—they lived on sturdy and strong while other forest trees matured and died in successive crops.

The Redwoods are the oldest living things in the world! Many were sturdy saplings 2000 years ago when the Three Wise Men of the East followed the

Star of Bethlehem to the manger wherein the Christian Saviour lay.

By a freak of nature the Redwoods grow nowhere else in the world but in California. Their range is confined to a strip along the Pacific Coast north of San Francisco Bay to the Oregon State line, and extending inland not more than 10 to 20 miles. The principal stand of commercial lumber today is in the three north coast counties of Mendocino, Humboldt and Del Norte. Their growth ranges from the sea level to an altitude of 2500 feet.

The Redwoods grow in what is known as the "fog belt," and thrive only in excessive moisture. There are millions of trees, and estimated by the Government to contain between 50,000,000,000 and 60,000,000,000 board measure feet of lumber-more than enough to keep all the saw-mills now cutting Redwood busy day and night for 100 years. The Redwoods grow big and dense, yielding on the average from 75,000 to 100,000 board feet of commercial lumber per acre. There are quite a number of instances where the Redwoods grow so dense and so big that a single acre has yielded more than 1,000,000 board feet of lumber.

The Redwood forest is one of the sublimities of nature. The massive trees, with their straight trunks covered with cinnamon-colored bark and fluted from the base to the apex of the tree like a Corinthian column, are as impressive as the cold, silent walls of an ancient cathedral. They grow from 5 to 25 feet in diameter, and from 75 to 300 feet in height. The great size and height of these trees can best be appreciated when it is known that, if hollowed out, one of the large Redwoods would make an elevator shaft for the famous Flatiron Building in New York; in height it would tower 50 feet above the torch of the Statue of Liberty in New York Harbor! They are so large that a single tree has produced enough lumber to build a church at Santa Rosa, California, that will seat 500 people.

The enormous logs make it necessary to use the most powerful and expensive logging machinery. Many of the large logs must be split with gunpowder before they can be handled on the saw carriage at the mill. It is not uncommon for a butt log (the first cut above the ground) to weigh from 30 to 50 tons, according to the diameter of the tree. The butt cut is usually 16 feet in length.

One of the strange things about the Redwoods is the root formation, which is slight in comparison with the size of the tree. Redwood actually has an insecure footing. There is no tap root to push straight down into the earth to give the tree stability. The roots radiate a few feet below the surface of the soil. It is supposed they protect themselves by dense growth. The floor of the forest is covered with a luxuriant growth of magnificent ferns and beautiful rhododendrons.

The Sequoia gigantea, or Sequoia washingtonia, as the United States Forest Service refer to them, are the "big trees" of the tourist. They are first cousins of the Redwoods. Geologists assert that they are the lone living survivors of all plant and animal life that existed before the glacial age. The few remaining trees are confined to an area of about 50 square miles on the western slope of the Sierra Nevada Mountains, in central California, and of which the Yosemite Valley is a part. Many of these trees are 4000 years of ageand some bold scientists have estimated one to be from 8000 to 10,000 years old! They are located in an altitude of from 4000 to 7000 feet above sealevel, and bear evidence of having passed maturity and are in their decline. If the decline lasts proportionately as long as it took the trees to reach maturity, they are still good for untold centuries. These "big trees" are found only in protected valleys and spots in the mountains, indicating the cause of their survival of the glacial upheaval. The "Grizzly Giant" in Mariposa Grove, Yosemite Park, is 91 feet in circumference at the ground, and its first branch, which is 125 feet from the ground, is 20 feet in circumference. The "General Sherman" is 280 feet high, 103 feet circumference at the ground, which means a diameter of 361/2 feet, and at a point 100 feet from the ground it is 17.7 feet in diameter. These are two of the most noted of the "big trees."

The "big trees" of California afford an inexhaustible reservoir of information for the scientist who reads this story of the past by the study of the annular ring growth. By means of this he is able to determine the season and locate with a degree of definiteness climatic conditions and changes on the Pacific Coast as far back as 4000 years ago!



A roomy, light, airy and most charming type of the Redwood bungalow, and especially suited to the large lot

The California Bungalow

HE bungalow is distinctly a California ideal. It is the architect's refinement of the original settler's cabin. To be a real California bungalow it must be built, from mudsill to the shingle roof, of California Redwood. The California bungalow is the most charming, cozy, and comfortable form of home. As a type it is the cheapest to construct and affords the most convenient arrangement for the family.

The bungalow is the type of home within reach of the ordinary purse, and it has been successfully transplanted to all parts of the country. If built of California Redwood it combines durability with fire resistance and makes possible unlimited combinations of artistic effects in the color scheme of its interior finish.

The House Builder's Wood

For home building Redwood is the most durable and serviceable material you can use. If Nature, when she created Redwood, had deliberately set out to most generously take account of our present-day needs in house construction, as well as our artistic appetites, she could hardly have improved her work. She achieved a miracle in making an "all-purpose" wood so richly adaptable to not only the rough, but also to the more refined uses of lumber. She put

into every Redwood tree a variety of grain, grade and texture probably not paralleled in any other species of wood.

In California, where Redwood is so well known, architects and builders recommend and use it where long life, artistic finish and "no-worry service" is wanted. Redwood is an asset in building.

From mudsill to shingled roof Redwood is ideally adaptable for every purpose, except uncovered interior floors.

CALIFORNIA REDWOOD

Redwood should be specified for:

All Exterior Trim

Balusters Ceiling Columns

Doors and Windows

Eaves Fencing Framing

General Mill Work

Gutters

Interior Trim

Lath
Lattice
Moulding
Mudsills
Newels
Panels
Pickets

Porch Flooring

Rails

Roofing (shingles and shakes)

Septic Tanks

Siding Sheathing Studding Sub-flooring

Redwood Best for Side Walls

The side walls of a house are as important as the roof or the foundation—they should be absolutely weather-proof, leak-proof, and impervious to dampness; they should last without expense, without paint if necessary, and should not crack, scale or rot, at the same time being capable of attractive treatment from an architectural viewpoint. Redwood beveled. resawn and drop siding are used universally for exterior covering in California, and they are fast coming into popular favor in the east.



A cozy, comfortable and inexpensive type of Redwood bungalow

Redwood is the most dependable wood for exterior trim. It is a general practice to use Redwood door and window frames in California. Where frames are made of other wood, Redwood is always used for that portion that comes in contact with the weather, as well as that part covered when the frame is set into the building and which is likely to be reached by moisture or rain seeping behind the casing. California houses built this way have no back rot.

More Durable Than Plaster

The plaster exterior has come to be a fad in many sections of the country. Its white, pebbly surface is attractive to the eye, but many architects doubt its lasting quality. This is particularly true in climates where there are extremes in temperature. A crack or scale on a plaster exterior mars its beauty, and the patch usually leaves an unsightly streak or blotch. Redwood siding, or a shingle or shake siding, is a covering that gives just as much artistic beauty as a plaster exterior. It can be stained or painted to any color, and adds to the value of your property because the exterior of your house looks just as uniformly attractive and is still as perfectly weatherproof 25 years after as it was the day it was built.

In planning your home you intend to build for comfort and beauty, as well as creating a live and growing asset in the property itself. If you sacrifice permanence and durability for the sake of temporary fad you make a bad investment. Redwood siding costs less than a plaster exterior, and it increases the value of your property.

Wonderful Interior Finish

The home—whether palatial or modest—when built of Redwood and finished with Redwood panels and beamed ceilings bears the stamp of enduring individuality. Who would not feel a thrill to know that he is living under the protection of the wood of the "big trees" of California—trees that began their earthly career coincident with the life of the Christian Saviour!

For interior finish, panels, moulding, etc., its adaptability meets every



The roof lines of this Redwood bungalow give a touch of the Orient



Strikingly simple in design and an inexpensive type. Note the beauty of this bungalow in its setting under the foliage of the California Pepper Tree. The sidewalls are Redwood shakes and the roof Redwood shingles

requirement perfectly. Redwood has an individuality all its own, and whether finished in the natural, or stained, it affords the architect the widest range of artistic possibilities as well as the greatest degree of satisfaction to the home lover.

For panels the "slash grain" gives a modest but beautiful figure because the annular ring growth of Redwood is, as a general rule, a close growth. "Vertical grain" is recognized by the absence of figure, and finishes with a beautiful but subdued effect. A careful selection for a combination of "vertical" and "slash grain" in panels or in trim is an ideal effect to be worked out by the architect or builder from his own ideas of contrast.

California Redwood has been used for years as interior trim for palatial homes both in California and in the East because of the exquisite effects attainable under the touch of the artist. The absence of pitch and raised grain also makes it a splendid material for carving and other similar decorative effort.

Waxed and finished in the natural, Redwood gives a rich, warm, inviting and never-tiring tone—Redwood makes you love your home.

By use of stains especially prepared for Redwood it can be shaded to any color desired, lighter or darker than the natural wood, and without destroying the beauty of the grain or its remarkable individuality. This makes it possible to harmonize the color tone of the room with the draperies, carpets, and so forth.

The California Redwood Association maintains a stain and paint expert, and we will gladly send you samples showing the wonderful range of color possibilities that can be realized by the use of these stains. The stain is not sold. We give the formula and complete directions on the back of each individual sample. If

the color you want is not among our standard stains we will cheerfully provide the formula upon request, and without cost to you. Any intelligent painter, interior decorator, or even a layman, can apply the stain satisfactorily if instructions are followed.

Resists Rot, and Doesn't Shrink

For contact with the ground as mudsills and underpinning, or for exposure to the weather as shingles, siding, exterior trim, porch columns and flooring, porch rails, etc., there is no wood as durable as Redwood.

When properly dried California Redwood does not shrink, warp, or swell. It is not affected by variations in temperature. Redwood doors "stay put"—they will not shrink, check or swell. A Redwood door can always be opened and closed without trouble. Redwood trim and panels do not shrink and expose unsightly edges.

Redwood Shingles and Shakes

Redwood shingles or shakes as a roof or side wall covering give long life and fire protection.

No other shingle, or substitute roof covering gives the ideal combination of rot resistance and fire retardance, with the additional merit of being rust proof and free from tar, gum or any other substance to melt in the sun and fill gutters, water pipes or drains.

Always lay Redwood shingles or shakes with zinc-coated cut iron nails. This will prolong the life of your roof many years. The ordinary steel shingle nail will rust out while the shingle itself is still in first-class condition. A Redwood shingled roof, laid with the right kind of nails, will give satisfactory service from 30 to 50 years.

The Redwood shake is a 36-inch long shingle, 6 inches wide, and 1/4 of an inch uniform thickness. For best



Another design of Redwood shakes for side walls

C A L I F O R N I A R E D W O O D



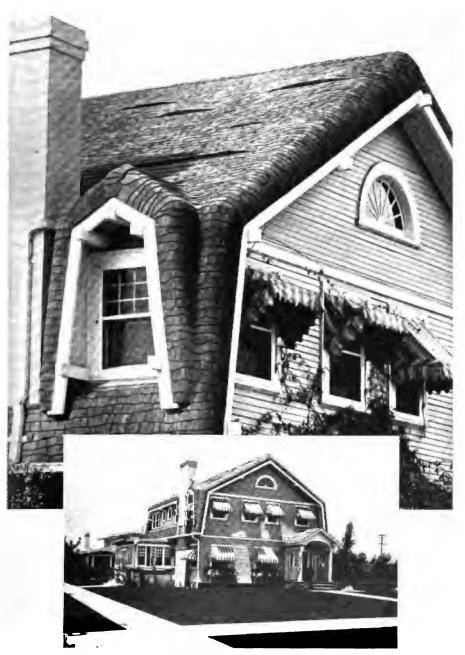
A combination of Redwood and plaster

service on roofs, one-third to onequarter pitch, they may be laid 24 inches to the weather, which means an overlap of 12 inches. When the roof is more than quarter pitch, a 6inch overlap, which gives a 30-inch weather exposure, will suffice, although a 12-inch overlap is recommended. There is no set rule for laying shakes to the weather, and the overlap can be varied to suit local conditions.

The Redwood shake, which may be either split or sawn, is a typical



Redwood's resistance to rot and the action of the elements makes it especially suitable for pergolas and porches—in fact, for all exterior uses



Showing the pliancy of the Redwood shingle. Residence of Ray Zug, Esq., Pasadena, California. The shingles were dipped in hot creosote and conformed to the roof design while hot. Roof laid five years ago, yet even the shingles bent to a reverse curve around the window are true to design—and they will stay so regardless of weather conditions

California covering, and ideal for everything from bungalow to barn. Both shakes and shingles are used extensively for side walls because of the artistic effects produced, as well as being a splendid weatherproof covering.

The Redwood shingle is sufficiently elastic to shape it in a reverse curve, if desired. This is done by soaking it in hot creosote before laying. In this way shingles can be bent around a curve (see photograph of the Zug home). In addition to giving it pliancy, the shingles can be laid true to the form desired, with assurance that they will hold their shape and the design of the roof indefinitely. In laying roofs this way it is necessary to use nails liberally.

Many homes in California have what are known as "thatched" roofs. This is a raised effect produced by increasing the number of layers of shingles. They are laid from 3 to 8 thick in the "thatch," according to the height desired.

You can buy Redwood shingles in two grades, No. 1 Clear and *A*. The former is a carefully selected vertical grain shingle, free from all defects, and is used invariably on coverings where service demands first consideration. The latter is a 10inch clear butt shingle, "slash" grain being no defect, and it is recommended for side walls rather than for roofing.

In 1893 Redwood shingles were taken from the roof of General U.S. Grant's headquarters, at Fort Humboldt, California, where they had been for 40 years. The wood was absolutely sound and without a trace of rot, although the shingles were worn thin by wind-driven sand.

A typical example of Redwood shingle service is found in the following letter from A. Cottrell, Eureka, Cal.:

"In the winter of 1870 I shingled my house at Eureka with Redwood shingles. They were first painted about the year



Showing use of Redwood boards for sheathing



More pretentious Redwood construction

1880, and again about 1895. The shingles were not removed from the roof of the house until September, 1913. They were in service 42 years, and, on being taken off the roof, were found to be in first-class condition."

Redwood Lath

Redwood lath have given most satisfactory service for many years, the fire-retarding property of Redwood giving lath of this material a decided advantage over the ordinary



A charming Redwood home under the California hills



Exquisite decorative possibilities of sand-blasted Redwood. Main entrance, Lancaster Hall Apartments, San Francisco. Rousseau & Rousseau, architects

kinds. For best results the rough coat of plaster should be allowed to dry thoroughly before applying the finish coat.

Sand-Blasting

Sand-blasting is not a new experiment on wood, but the texture and grain of Redwood make it possible to apply it with exquisite results.

Sand-blasting is done by using a sharp sand and cutting through metal stencils.

Almost any figure can be produced by the skillful handling of the sandblasting tool.

The absence of pitch and wide hard grain, and the close rings in the Redwood impart a remarkably beautiful effect. The most satisfactory sand-blasting work is done in vertical grain pieces. The wood must be thoroughly dry to insure the best results.

Sand-blasted Redwood, combined with stain by which any color tone desired may be achieved, makes a remarkably beautiful and artistic combination in a decorative way that is especially suitable for hotels, apartment houses, public buildings, as well as in the modest home, for this is not an expensive treatment.

Mill Work

The texture of Redwood makes it a splendid wood for mill work of all kinds. From a manufacturing standpoint it can be handled more economically and works with less waste than almost any other wood.

It is manufactured into all kinds

RESISTS FIRE AND ROT



A splendid example of Redwood shakes for exterior walls and shingles for roof covering.

Residence of H. O. Harrison, Esq., St. Francis Wood, San
Francisco. Ward & Blohme, architects

of general mill work, such as frames for doors and windows, mouldings, columns for interior and exterior, newels, balusters, rails, spindles, pickets, battens, trim and specialty products. Many are built up on the linderman machine, with its dovetail glued joint—a joint that Redwood makes perfectly.

Redwood mill work is preferable, from a consumer's standpoint, because of the wide range of possibilities in connection with its finish. It can be waxed in the natural; it can be stained to any color desired, or it can be painted or enameled. The natural surface of Redwood is an excellent base for white enamel because it can be sanded to a smooth surface that produces a glassy finish.

The individual Redwood lumber companies have elaborate catalogues on the different standard planing mill products, which will be sent on request by those mills.

Mantels

As Redwood can be worked readily to beautiful decorative effects and has a high resistance to fire, some of the most beautiful mantels in the Western country are made of Redwood.

Redwood mantels always hold their joints, and decorative work, whether carving, sand-blasted or merely high polish, can be applied to Redwood easily and in a thoroughly satisfactory manner. The natural surface of Redwood is such that it takes and holds glue with a tight grip, and it can be depended upon to hold its shape.

Its resistance to rot insures a long life which applies as much to damp-

CALIFORNIA REDWOOD



Intersor of the Harrison residence, St. Francis Wood, San Francisco, showing Reawood finished in white enamel. Ward & Blohme, architects

ness that may get in behind the mantel in the brick work as it does to dry rot.

Pergolas

The pergola—the garden shade and adornment of ancient Greece and

Rome—is fast growing in favor for its utility and decorative effect on the lawn. The pergola is the final artistic touch to the home.

Like the sleeping porch, the pergola, because of its being outdoors, should be built entirely of Redwood



Dining room of the "Home of Redwood." The charm and beauty of Redwood for interior finish was clearly demonstrated in this bungalow at the San Francisco exposition



The "Home of Redwood" at the Panama-Pacific International Exposition, San Francisco, 1915. This bungalow was built throughout of California Redwood. Louis Christian Mullgardt, architect

—of Redwood columns, girders, flooring, rafters and lattice. Then you will have no rot due to contact with the ground or exposure to weather.

Redwood columns are built of staves properly dried, and there is no shrink, warp, or swell to throw them out of alignment. Redwood's perfect adaptability to paint also contributes to the reasons why it is the best wood for a pergola.

Sleeping Porches

Modern medical science recommends out-door sleeping for sturdy bodies and the joy of healthful living.

The sleeping porch, therefore, has come into vogue. Thousands are being built on homes throughout the country every day.

Redwood should be used in building the sleeping-porch because of its splendid weathering qualities — in fact, the nature of the wood is perfectly adapted to this usage.

A sleeping porch is an economy in the reduction of doctor bills, and a Redwood sleeping porch is an actual saving in the long run. It should be built entirely of Redwood.

The Home of Redwood

"The Home of Redwood" was a magnificent Redwood bungalow at the Panama-Pacific International Exposition, in San Francisco, in 1915.

The foundation, underpinning, floor joists, and frame are all built of Merchantable Redwood.

The entire building is sheathed inside and out, with surfaced one-inch Construction Redwood, building paper being put next to the sheathing and immediately underneath the exterior and interior finish.

The roof is covered with Sawn Redwood Shakes dipped in shingle stain before laying.

WILL NOT SHRINK, SWELL OR WARP

The sides are covered with a combination of Sawn Redwood Shakes and a special pattern of Clear Dry Redwood Siding.

The bathrooms, kitchen, pantry, and servants' room are finished in select Dry Tongue-and-Groove Redwood.

The other rooms are finished in Clear Dry Redwood Panels, as shown in the accompanying photograph.

This bungalow was awarded the Grand Prize by the Exposition Commissioners, which is the highest possible recognition that the Exposition could bestow.

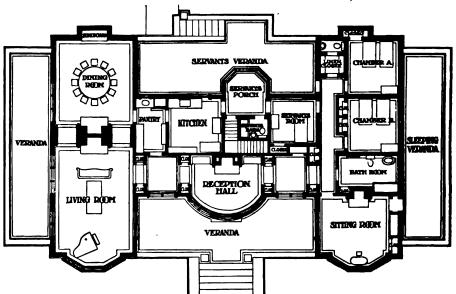
After the close of the fair the bungalow was sold for \$4,000 (the highest price paid for any of fair buildings) and it was moved onto a float and towed across the Bay of San Francisco and it is now one of the most beautiful country homes near San Rafael.

Be Sure and Use Redwood

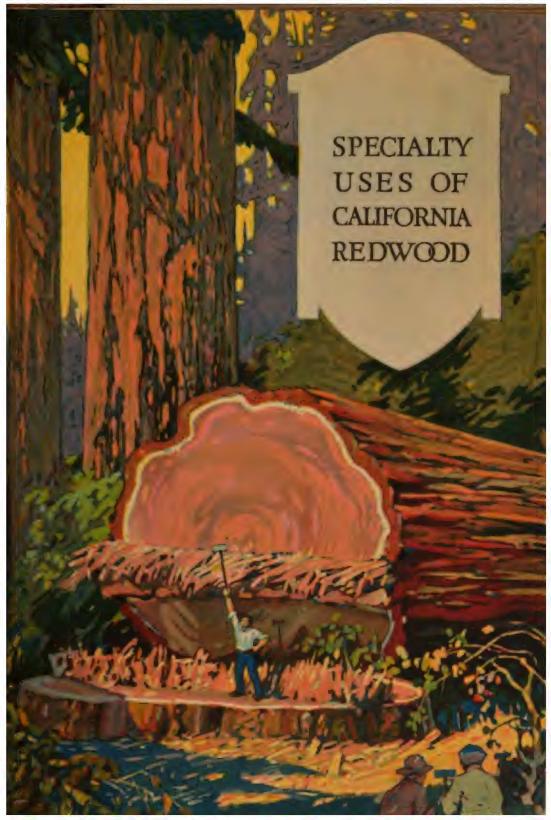
Do not specify any wood until you have thoroughly investigated what Redwood means as a home-building material. Redwood is not expensive. It may be slightly higher than some woods, depending upon locality. When you build with Redwood you save in the long run any increased first cost by avoiding the necessity of continual patching and repairs.

California Redwood can be had in your locality. Inquire of your local retail lumber dealer—he will see that your requirements are supplied. Should you have difficulty in securing Redwood, or specific information about it, write us—we are here to serve you.

CALIFORNIA REDWOOD ASSOCIATION
Call Building
San Francisco, California



Floor plan of the "Home of Redwood"



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SPECIALTY USES OF CALIFOR CALIFORNIA REDWOOD

CALIFORNIA REDWOOD ASSOCIATION SAN FRANCISCO

Copyright 1917 by California Redwood Association



Insulating boxes of 1-inch surfaced and matched Redwood built around brine pipe in engine room of National Ice and Cold Storage Co., San Francisco, 15 years ago. Temperature of pipes 5° above zero. Temperature in engine room 80°. Frost on inside of lower box is gradually forcing the box out of shape. In spite of great difference in temperatures on opposite sides of this 1-inch Redwood there is no shrink, check or decay. Insulation of Redwood is shown by absence of frost on outside of box

Specialty Uses of California Redwood

Insulation—Ice Houses

A large manufacturer of silos in the East, one of the pioneer concerns in the use of Redwood for silos, makes the statement that 2 inches of Redwood is equivalent to 30 inches of concrete in insulating power. This manufacturer has studied Redwood thoroughly from this angle for the reason that the success of a silo depends upon the non-conductivity of

the silo wall—as dissipation of the natural heat of the silage through the silo wall increases the per cent of waste silage.

Redwood in growth structure is porous, and, when studied under a microscope, looks very similar to a comb of honey between the dark annular rings. Every one of these millions of cells in the growing tree is full of sap, but when the tree is cut into lumber the lumber must be "sea-

soned" or dried, before it goes into commercial use. This "seasoning" process consists merely of evaporating the natural moisture out of these cells. Each cell, therefore, becomes a dead air space.

The cellular make-up of Redwood is uniform both in the thickness of the cell wall as well as the size of the cell. It is plainly evident, therefore, that heat applied to one side of a piece of Redwood, to travel through the Redwood must pass through a thin cell wall, then a dead air space, then another cell wall and then another dead air space, and so on. Heat passing through this combination rapidly dissipates.

Prof. L. J. Towne, of Columbia University, gives the relative power of conduction as I to 20 between wood and stone, cement or clay products. This means that stone and cement are 20 times a better medium for the conduction of heat or cold than is wood. The millions of dead air cells between the annular rings of Redwood are what give Redwood its insulating power.

Manufacturing plants on the Pacific Coast use Redwood as a substitute for cork board for insulating.

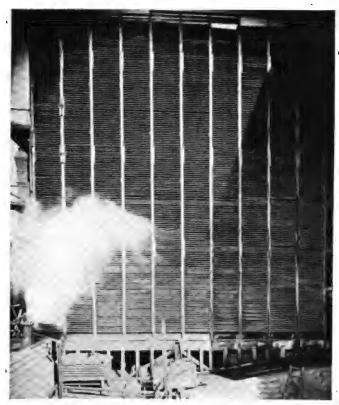
There are some splendid examples of Redwood's insulating power, as well as its remarkable longevity under the most severe service, in the old plant of the National Ice and Cold Storage Company, at Kentucky and Division streets, San Francisco. This plant was built in 1902-15 years ago-and Redwood was used throughout. The system of brine piping is encased in Redwood boxes made of one-inch matched and surfaced Redwood. Nearly all of these insulation boxes are still in use. The temperature in the brine pipes is 6 degrees above zero, and they have gradually built up around the pipe, inside of the box, an incrustation of frost that completely fills the box. In spite of the fact that the temperature of the inside of these insulation boxes is 6 degrees above zero, and the temperature in the engine room of the plant is 80 degrees, there is no shrink, warp, swell, twist or check in these boxes, nor is there any gathering of frost on the outside of the box which would indicate free conductivity through the wood.

Not only this plant, but most of the ice houses on the Pacific Coast use Redwood as lining for cold storage and ice rooms. In the plant above referred to there are ice storage rooms that have been in continuous use for 15 years, and where Redwood has been incased with frost and ice for that period, and in spite of this severe service these rooms are thoroughly air-tight—the joints of the wood are tight.

Roofs

Redwood possesses a number of qualities that make it highly preferable for roofs, and particularly in factories where there is humidity and condensation to contend with. It has been found particularly serviceable in connection with the so-called "saw tooth" type of roof.

In many kinds of business such as cotton mills, paper mills, etc., where there is humidity or rising steam, there is trouble with condensation that drops back onto the products handled and creates a manufacturing loss. This is due to the fact that the roofing materials do not properly insulate the sharp differences in temperature between the exterior and interior, and particularly where there is severe cold weather.



Cooling tower made of Redwood frames and lattice at plant of National Ice and Cold Storage Co., San Francisco

Redwood's natural resistance to decay under moisture or humidity gives it a maximum of life, while its inherent resistance to the attack of acids or alkalis, or the fumes of chemicals makes it preferable in cases where such conditions prevail.

It is light in weight and sufficiently strong under proper design.

Redwood also possesses the necessary attribute of holding its shape—when wet it does not swell and, when again dried, does not shrink perceptibly. Redwood is not sensitive to severe changes of temperature or atmospheric conditions which set up

counteracting strains in wood. It can be depended upon to hold its shape when one side is subjected to freezing and the other to heat or humidity.

Redwood is a thoroughly satisfactory surface to paint. Its porosity affords a firm grip for the paint and makes it possible to get a thorough coverage. As Redwood, when thoroughly dry, is subject to a minimum of movement in the wood itself under varying conditions of heat or moisture, there is a minimum tendency to check the paint film from such cause.

WILL NOT SHRINK, SWELL OR WARP

It is not necessary to subject Redwood to artificial preservatives to give it durability-it possesses a natural durability that resists rot both incontact with water, moisture or humidity, or subjected to conditions of heat or dryness, or severe alternating dry and moist conditions. Redwood can be denied ventilation by sealing in metal, and under conditions of this kind it has a high resistance to dry rot; this same resistance to dry rot is present even if the wood is not denied air.

In Redwood, as in other woods, the heart stock will last longer than the sap.

There is a sharp distinction between heart and sap in Redwood, as the natural color of the heartwood is a soft reddish-brown, while the sapwood is white. Redwood sapwood, however, is as durable as any other soft wood when painted.

Greenhouses

Nurserymen on the Pacific Coast have for years recognized the superior service of Redwood for greenhouse purposes, and a number of builders of greenhouses and greenhouse appurtenances in the East are



Ice storage room of National Ice and Cold Storage Co., San Francisco. In spite of 15 years of severe service, the room is air tight and the Redwood lining and timbers are free from decay

also enthusiastic advocates of Redwood.

Redwood's remarkable durability in contact with moist soil, and the fact that it is unaffected by sudden changes in temperature or atmospheric conditions, make it highly preferable for sash bars and muntins. Glass laid on Redwood greenhouse moulding does not become loose, rattle, and shatter because of decay in the moulding.

Redwood makes a "stay - tight" joint, and therefore a leak - proof glass roof. Redwood does not swell perceptibly when wet, nor shrink and twist when again dried.



Because of Reduced's resistance to rot when in contact with moist earth it was used for the boxes with which were built up the famous Mesembryanthemum hedges at the Panama-Pacific International Exposition, San Francisco, 1915

It is the most lasting and durable wood that can be used for benches, propagating boxes, lattice, "cold forms," "hot beds," etc.

Redwood does not have to be treated to give it durability in contact with the ground; neither does it swell nor twist out of shape because the inside of the propagating box is in contact with wet ground and the exterior is dry.

It resists attack by insects, and does not develop fungus growths.

The use of Redwood about the greenhouse insures a maximum service, as well as being the easiest wood to work and the most satisfactory material to handle.

Redwood in the greenhouse cuts the repair bill to a minimum.

The following letter from the vicepresident of the King Construction Company, North Tonawanda, N. Y., one of the largest designers and builders of greenhouses in the country, shows how highly they regard Redwood for greenhouse purposes:

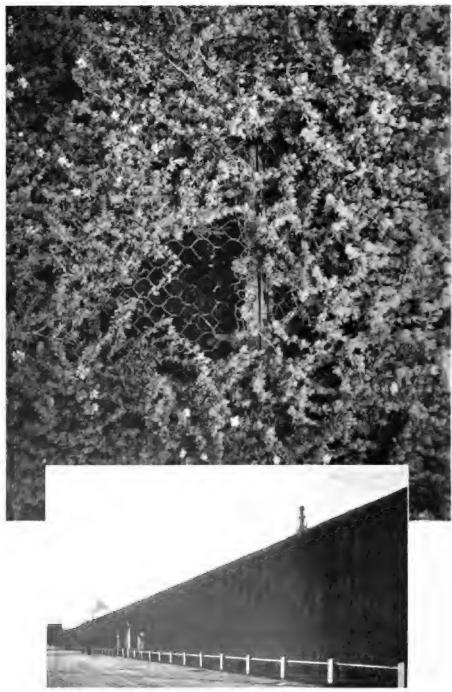
> North Tonawanda, N. Y., Feb. 19, 1917.

California Redwood Assn., San Francisco, California.

Gentlemen: We note by the little circular which you enclosed with your letter of February 13th that you show a couple of greenhouses which we built at Newton Falls, Ohio, these houses having been built throughout by our company of California Redwood.

Perhaps you would be interested in knowing why we use Redwood for greenhouse work.

We have tried various kinds of woods that we thought might be suitable for greenhouse work for the past 20 years, and we have found Redwood



Mesembryanthemum hedge at Panama-Pacific International Exposition, San Francisco, 1915. Mesembryanthemum was grown in boxes of Redwood (chosen for its rot-resisting qualities), and the boxes were then stacked to the required height and shape

CALIFORNIA REDWOOD



Redwood lattice roof over the Botanical Gardens at the Panama-California Exposition. San Diego, 1915-1916. Redwood was used in this permanent building because of its ability to withstand severe service of this type

to be the most durable and serviceable of any of them.

- That it is less subject to decay in the severe conditions of heat and moisture existing in a greenhouse.
- 2. That it is less liable to warp and twist than other woods.
- 3. That it does not shrink or swell,
- 4. That it runs more uniform straight grain than the next best wood, which we consider to be _____
- 5. That it takes paint much better and the grain does not raise.
- That it is much easier to detect and eliminate the sap on account of the heart wood being red and the sap wood white, whereas in other woods this difference in color is not noticeable so much.
- 7. That it has invariably been satisfactory to all our trade.

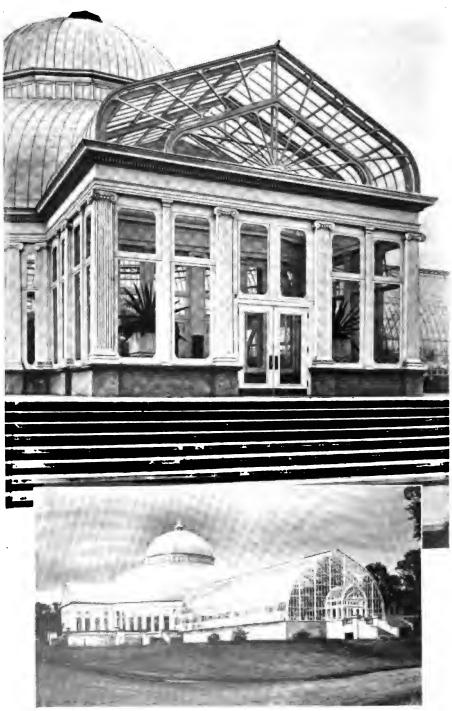
We would be glad to answer any questions from any of your customers giving further details of our experience.

Yours very truly, (Signed) E. P. Lovejoy, Vice-President and Gen. Manager.

Redwood Lath

Redwood lath have given most satisfactory service for many years; the fire-retarding property of Redwood giving lath of this material a decided advantage over the ordinary kinds. For best results the rough coat of plaster should be allowed to dry thoroughly before applying the finish coat.

The Eureka High School, erected at Eureka, California, is a recent instance of the use of Redwood lath in a building of the most modern construction.



Redwood was used for this conservatory at Como Park, St. Paul, Minnesota, Erected by King Construction Company, North Tonawanda, New York



Redwood's long life when in contact with the ground makes it especially desirable for casket shells and coffins

Casket Shells, Coffins, and Burial Boxes

Ninety-eight per cent of the burials in California are in Redwood caskets, coffins or burial boxes.

Redwood is highly preferred for this purpose because of the splendid protection it affords by reason of its wonderful durability in contact with the ground. A Redwood coffin or burial box can be depended upon to remain intact for many years.

Manufacturers of coffins and burial boxes prefer Redwood because it is light and saves freight. It is easy to work and makes a tight joint that does not pull apart, and, in addition, it is a surface that can be stained to any desired effect.

The Redwood casket or coffin retains its shape long after coffins made of other woods have failed and fallen to pieces.

Used by Government

The United States Government contracts for large quantities of Redwood coffins, most of which are sent to the army posts in tropical countries. The army prefers the Redwood coffin because it affords the highest type of protection to the body. The Redwood coffin is particularly serviceable in tropical countries by reason of the fact that it resists attack by the termite or white ant, which rapidly destroys most other woods.

Just one of many similar letters on file:

WESTERN CASKET COMPANY 320-330 TENTH STREET

Oakland, Cal., Nov. 21, 1916.

CALIFORNIA REDWOOD ASSN.,

San Francisco, California.

Gentlemen: When we first began business, something more than ten years ago, we were using in part some other wood than Redwood, but very soon found that by far the best for our porpose was Redwood. It works up far more smoothly than other woods and therefore when a nice covering is placed over it and the casket trimmed it gives a far better appearance than other wood, because of the fact that it does smooth down under the sander.

Californians know that Redwood lasts under ground almost indefinitely.

This wood is much lighter in weight than other wood and therefore the freight on Redwood caskets is much less, as well as on the outside or shipping boxes made of the same. This makes a considerable saving to the shipper.

In our opinion, there is no comparison between the Redwood for our purpose and any other wood.

Very truly.

WESTERN CASKET COMPANY, F. J. Mayhew, President.



A Redwood incubator

Brooders and Incubators

Manufacturers using Redwood for incubators and brooders are enthusiastic over its perfect adaptability.

An incubator, because of the difference in temperature between the interior and the exterior, requires a wood that holds a tight joint, is unaffected by differences in temperature, or alternating wet and dry atmospheric conditions.

Tight joints keep out drafts and give a higher working efficiency to the incubator.

Redwood's insulating power, its light weight, the ease in working, its resistance to rot and fire, as well as its splendid surface to take and hold paint, are additional favorable factors.

The following letter from the president of the Petaluma Incubator Company sets forth the experience of one of the largest manufacturers of incubators and brooders in the country:

Petaluma, Cal., Sept. 30, 1916.

EDWIN E. MYERS, Sec. Manager, California Redwood Association, San Francisco.

Dear Sir: Before coming to California the writer used pine and other

woods grown in Canada, but on coming to California Redwood was the most convenient to secure, and it proved to be a very happy result, for the Redwood used in these goods never shrinks or swells, and hence when we make good close joints to begin with, it remains so. Incubators made by us nearly forty years ago are still in use and, so far as the joints are concerned, they are as close now as when the machines were first constructed.

In our experience there is no wood which has come within our range that can equal or approach California Redwood for making incubators and brooders, and so thoroughly were we convinced of that, more than thirty-five years ago, that in all the time since we have not used other lumber.

We have found that in shipping our goods to the Philippine Islands, Australia, India, South Africa, South American countries, such as Argentine, Uruguay, Brazil, Peru, and Chile, that the Redwood stands the ravages of the insects, such as the great white ant. These insects, which seem to enjoy making a breakfast of other kinds of wood, will not touch the Redwood.

In addition we have shipped to almost every place on the globe. Our incubators are used in Jerusalem, in Cairo, Egypt, in many of the islands of the Pacific and Atlantic oceans, and in the countries south of us, such as Mexico, Guatemala, Nicaragua, and even in the Canal Zone at the Isthmus. In some of the latter mentioned sections we regard the climatic conditions as trying on any kind of wood. There is no complaint, however, with Redwood.

Respectfully,

PETALUMA INCUBATOR COMPANY.

L. C. Byce, President.

Ice Cream Cabinets

Redwood is extensively used for the manufacture of ice-cream cabinets. It has been found by actual experience to be suited for this service.

Experience is the most satisfactory demonstrator. Read what The C. Nelson Manufacturing Co., of St. Louis, say about their experience with Redwood:

C. NELSON MFG. CO.

St. Louis, U. S. A., Aug. 29, 1916. CALIFORNIA REDWOOD ASSN.,

San Francisco, California.

Gentlemen: In answer to yours of the 23rd, will state that we found Redwood to be a better non-conductor of heat and cold than any other wood we could get, and, being light, it was less cumbersome to build our cabinets from, as they have to be taken in every fall and put out every spring for service.

We also find that by using wide boards we have no glue joints; constant moisture and sometimes freezing would part these joints.

They also take on a beautiful finish in almost any color desired. The small parts that have to be glued for lids and rings hold better than other wood.

Redwood does not warp if properly seasoned before it is used.

Cabinets we built 15 years ago of Redwood, with sides 25½" wide, all in one piece, come in for repairs in perfect shape, and can be redressed and finished to look almost like new.

We shall probably never use any other wood for the building of Nelson cabinets...

Fifteen years ago we built 10 cabinets and sold them for \$100. This year our sales will amount to something over \$100,000. Fifteen years ago it was a new proposition to the ice-cream world. A great many thought it an unnecessary expense, but have since found it a very necessary ad-

junct. It is growing every year and we never have a complaint from our customers.

> Yours very truly, (Signed) C. Nelson Mfg. Co., C. Nelson, President.

Boxes and Chests

Redwood is excellent material for a high grade clear box as a container for bulky goods of light weight, such as shirt waists, cereals, wearing apparel, etc.

A number of candy shops on the Pacific Coast are using with great success a small Redwood box as a shipping container for candy.

These boxes are made of clear, dry Redwood, and are labeled as "wood from the 'big trees' of California." This gives the box a sentimental value, and, as the box is neatly made, it usually finds a permanent place in the recipient's home for some other purpose.

A manufacturer of boxes in the east recently arranged for a large amount of Redwood to be used for shirt waist boxes. The Redwood is cut thin, and the completed box is covered with matting glued to the wood. These boxes are to be used to ship shirt waists to tropical countries.

Redwood chests are splendid for storing wearing apparel, valuables, etc. The ease with which the surface can be worked for decorative purposes makes it possible to produce a handsome and extremely durable chest that is a rapid seller. Many Redwood chests are decorated with a sandblast figure. They can also be stained to any color desired.

Manufacturers of office filing equipment use Redwood for file transfer cases because of its light weight and ability to hold a tight glued joint.

Storage Battery Purposes

If Nature had determined to grow a wood especially suitable for storage battery uses, and particularly as separators, she could not have improved upon Redwood.

Redwood meets these requirements satisfactorily. In fact Redwood is so perfectly adaptable for battery purposes that the Electric Storage Battery Company, of Philadelphia, Pa., has taken out letters patent on the use of Redwood in their batteries, and in which patent the following statement is made:

"The quality common to these woods that adapts them to storage battery separators includes the property of not swelling when wet and consequently, when again dried, of not shrinking, warping or twisting to an extent that unfits them for use as separators when dry or dried. Dry separators of this material can be used without the customary allowance for swelling when immersed in the electrolyte of the battery or other soaking solution. This quality also includes the property of these woods which is due to their density and which causes them to act as a diaphragm impervious to battery sediment, yet they are sufficiently porous for absorbing the electrolyte and permitting of the free passage of current; and this quality includes substantial freedom from deleterious organic matter such, for example, as acctic acid, which injuriously attacks the positive pole plates; and this quality further includes sufficient mechanical strength and the property of resisting the destructive action of the electrolyte.

"From the foregoing it is evident that the separators of this invention meet all the requirements of use in a storage battery, and further that they can be dried even though they may have been previously treated with acid or alkaline solutions or both, followed by washing in water, as is customary in order to remove some of their ingredients which would attack lead or be otherwise deleterious.

"The advantage of dry separators over those which have to be kept wet is obvious. The strength of the woods from which I make the separators is so great that even if the separators are treated in the manner above referred to they still retain ample mechanical strength for use in a storage battery. However, these woods contain so little deleterious matter such as would attack lead that they can be used without any treatment at all or with very little treatment.

"For the sake of further explanation it may be said that the quality or characteris-

tic which I have discovered in the certain woods to which reference has been made is that they can be soaked until they are flimsy and then dried again satisfactorily.

"I do not claim in this application a storage battery separator made of woods of the tribe TAXODINEOE, generally of the genus TAXODIUM or of the species TAXODIUM DISTICHUM, since the same forms the subject matter of my application executed of even date herewith and serially numbered 637.532, but

What I claim is:

"r. A storage battery separator made of wood of the genus SEQUOIA.

"2. A storage battery separator made of wood of the species SEQUOIA SEM-PERVIRENS.

"3. A storage battery separator made of dry wood of the genus SEQUOIA.

"4. A storage battery separator made of dry wood of the species SEQUOIA SEM-PERVIRENS.

"5. A storage battery separator made of treated and dry wood of the genus SE-QUOIA.

"6. A storage battery separator made of treated and dried wood of the species SEQUOIA SEMPERVIRENS."

This patent is No. 1,012,751, and was granted December 26, 1911.

Organs

The highest possible evidence of Redwood's "staying-put" quality can be found in the fact that it has been used for years with absolute satisfaction as a material from which pipe organs are made.

The organ is a delicate instrument, as the slightest leak would be disastrous to the tone.

The organ manufacturer cannot use a wood that varies in the slightest, either through change in temperature or atmospheric conditions, or a wood that contains pitch or gummy substances to deaden the resonance of the wood or leak into valves.

The following letter from the secretary of the California Organ Company of Los Angeles indicates the high confidence that company has in Redwood:



Striking evidence of Redwood's non-shrinking quality. Sound-producing pipes of California Reawood in the magnificent pipe organ in the First Universal st Church, Detroit. The slightest shrink or other movement in the Redwood pipes would destroy the tone of the instrument!

THE CALIFORNIA ORGAN CO.

Los Angeles, Cal., Sept. 12, 1916. CALIFORNIA REDWOOD ASSN.,

San Francisco, California.

Gentlemen: In regard to Redwood in the manufacture of pipe organs, there are, of course, several reasons for our using the same.

The woods usually used in this type of construction, or those which have been used in the past are white cedar and sugar pine.

A government report shows the relative value of Redwood, white cedar and sugar pine in the order mentioned, concerning the lasting qualities, absence of swelling and shrinkage, and the absence of pitch.

The principal advantage to us is the

absolute assurance that our work is going to stay "put" after completion. For instance. a Redwood pipe does not expand or contract under a great variety of climatic and atmospheric conditions. This is extremely essential as the cubical area of the pipe concludes the pitch, and should a pipe move from its fixed position an instrument would move slightly out of pitch.

In the chests of an instrument we find Redwood to be of exceptional value. There are hundreds of small felt and leather valves, and should the wood exude pitch these tiny parts would stick and refuse to work. It is also an advantage in chest work as it is essential that these chests should be airtight, and the possibility of checking is minimized in the use of properly dried Redwood.

An advantage in favor of Redwood for the manufacture of swell boxes and the

larger pipes is the fact that Redwood is obtainable in any dimensions, extraordinary width being demanded at times.

There are two other important reasons. In the matter of cost, as compared with the woods used by other manufacturers in this line, the initial price as compared to sugar pine is approximately 50 per cent; as compared with white cedar, Redwood is slightly lower in price and is vastly superior to it. It also has the advantage of being light, consequently shipping rates are greatly reduced.

In closing we beg to advise that we have delivered instruments constructed of Redwood from New York City across the continent to Honolulu, and have absolutely no difficulty with Redwood parts.

Very truly yours,
(Signed) THE CALIFORNIA ORGAN Co.,
A. E. Streeter, Secretary.

Clock Hands

Light weight, absence of shrink, warp and swell, together with resistance to rot when damp or encased in metal and denied ventilation are bringing Redwood rapidly to the front as the best wood to be used as hands for large clocks in public buildings.

Most of these clock hands are covered with copper or bronze.

A notable example of Redwood clock hands is that on the Custom House, Boston. The minute hand is 16 ft. long, and weighs 141 lbs. The hour hand is 12 ft. long and weighs 112 lbs.

The following letter from the E. Howard Clock Company, Boston, Mass., who built and installed the clock, is an unquestioned testimonial of Redwood's splendid adaptability for this purpose:

Boston, Mass., June 22, 1916.

CALIFORNIA REDWOOD ASSN.,

51 Newhall Building,

San Francisco, California.

Gentlemen: In reply to your secretary's inquiry of the 7th inst., would say that the reason we selected Redwood for the Boston Custom House Clock hands is because of its extreme lightness, which in this instance was very important.

In addition to being very large hands, the Government specifications required that they should be completely metalized, or, as we call it, armor

Because of the four pairs of hands for that clock having proved very satisfactory, we expect to use Redwood in the future. . . . We agree with you



Redwood was used for the clock hands on the Custom House, Boston, because of the wellknown resistance to rot and light weight of the wood of the "big trees" of California

that Redwood is a very desirable material, but of course it is quite expensive and it has to come from a very long distance.

We enclose two reprints from the Architectural Review, relating to that particular clock, which we would be glad to have you put up in the rooms of your Association.

Very respectfully yours,

THE E. HOWARD CLOCK CO., By E. A. Bigelow, Treasurer.



Fire-proof door, showing Redwood core used under the metal covering. Approved by the Fire Underwriters Association

Fire-Door Cores

Redwood is one of the four woods specified by the Fire Underwriters Laboratories as a material from which fire-door cores should be built.

Of these four woods Redwood is the first preferred, for these reasons:

- Natural resistance to fire because of slow ignition and slow burning.
- 2. Absence of pitch, resin, or other inflammable elements.
- 3. Does not dry rot when denied ventilation.

- 4. Willnot "wet" rot due to moisture from sweating metal.
- 5. Light in weight, strong, and easy to work.
- 6. Always hangs true, and is not affected by swelling or shrinking in the core by reason of moisture or dampness that might penetrate through steaming, sweating, etc.

The following letter from a large Pacific coast manufacturer of fire doors is based on years of practical experience:

CALIFORNIA FIRE-PROOF DOOR COMPANY

1931 SOUTH LOS ANGELES STREET Los Angeles, Cal., Aug. 16, 1916.

CALIFORNIA REDWOOD ASSN., San Francisco, Cal.

Gentlemen: In reply to your letter of August 15th.

There has been much discussion on the relative merits of various soft woods to be used in the construction of fire doors.

In my experience I find that Redwood is the best wood in all cases, it having, you might say, no pitch in it, which makes it almost non-burnable. Also, it does not dry-rot when enclosed by metal and denied ventilation.

Most woods I have noticed that are incased in metal will sooner or later dry-rot, and I have noticed a number of doors after having been enclosed for seven or eight years were reduced to a scrap or junk through dry-rot.

We are the largest manufacturers of fire doors on the coast, and we have never had one complaint about our material going bad. In fact, in the course of a change in one of the Pacific Telephone Buildings in San Francisco, the engineer in charge cut one

CHINOTHE COLLON House CHINAMA

SIO CALIFORNIA STREET TELEPHONE, DOUGLAS 2648 OFFICE HOURS IO TO II A. R 60.000 sansanasa 60.000 Leathery spee

April 11th, 1917.

California Redwood Assn., San Francisco, Cal.

Gentlemen:

With reference to your communication of the 7th inst., would advise you we have selected redwood in many errs of our new building on account of the resistance this lumber has to dee y and deterioration and also on account of its resistance to fire. We particularly selected redwood or our elevator shaft on account of the well-known realistance of this sood to fire. The construction of our staff is Ex6" redwood timbers placed on top of seach ther, making a solid wall 6" thick.

to gladly recomend this lumber to anyone desiring slow barries construction.

Tours very truly,

CALMONIA COTTO MILES CO.

JRM-NEE.

A strong letter on Redwood's rot and fire resistance

of the metal doors in two that we manufactured; the door in mention having been in place for about eight years, and he, the engineer, returned a part of it to us and a letter stating that the door was in just as good a condition as the day we manufactured it.

Also, another thing that I noticed on the Redwood doors is that after they had been subjected to a fire they are not burnt up. I could cite a number of incidents, but I remember one in particular in which I went to examine the doors after a fire. I found that the door next to the fire had been charred possibly one-quarter of an inch deep. The fire did not get in any further; in fact, it stopped, and as I said, this is due to the fact that there is no pitch in the wood to help it burn.

After the fire at the Times Mirror Company's plant (the Los Angeles Daily Times explosion), I noticed on the building across the alley there was a shutter protecting a window opening. Considering the great heat from the explosion and fire the shutter had fulfilled its duty much more so than any other protection used on the adjoining window. In fact, some of them had hollow metal windows and frames and they had gone absolutely to pieces, but this Redwood shutter kept the fire out of this particular opening; and without doubt in my mind if they had been used on the adjoining openings they would have saved that building.

In conclusion, you can see where I stand regarding the use of Redwood. We will not use anything else because I deem it that our customers are entitled to the best and it is up to us to see that they get it.

Yours very truly,

CALIFORNIA FIRE-PROOF DOOR Co.
(Signed) Mgr. J. A. Mottashed.

Fire Walls

Redwood's slow ignition, slow burning and the ease with which fire is extinguished have made it the recognized material for fire doors.

Experience on the Pacific Coast has demonstrated that a solid Redwood fire wall will perform its function satisfactorily.

Building ordinance No. 399, of the city of Eureka, California, is typical of the permitted use of Redwood for fire-wall purposes, and reads as follows:

Sec. 2. The exterior walls and all party walls of the buildings included within the district above described, shall be constructed of concrete or brick, natural or artificial stone, or iron or a combination of any or all of the above described materials, or of **Redwood** as provided by this ordinance.

Sec. 3. The height of all wooden buildings hereafter constructed within the fire limits shall be limited to 50 feet, from the sidewalk grade to top of fire wall or peak of roof.

Sec. 4. All wooden buildings hereafter erected within the fire limits of the city of Eureka, except those built for, and used exclusively as dwelling houses, outhouses, and private stables, shall be constructed with solid walls, the same to be not less than four inches thick in all one and two story buildings, and in all three or more story buildings, the two upper stories shall be constructed with solid walls of like thickness, and the lower story or stories shall be constructed with solid walls not less than six inches thick. The above thickness of walls to be exclusive of plaster, weather boarding or rustic.

All frame buildings with studded walls or where the walls are not solid, shall have their outer walls covered with rustic or weather boarding, and the walls of such frame buildings shall not come in contact with, or be within twelve inches of, the walls of any other building. Such intervening space shall not be enclosed higher than six feet from the ground.

Electrical Specialty Work

The absence of pitch or gummy substances, its straight even grain, its non-conductivity, and its resistance to fire are the features that make Redwood preferable for electrical mouldings and specialty work.

Screens

As Redwood is light, easy to work and makes a satisfactory and permanent joint it is in demand for the manufacture of screens.

This applies to the fly screen as well as special work such as screens for moving pictures, portable screens for the home, etc.

The absence of pitch or raised grain and the natural surface of the wood lend it admirably to decorative purposes, either by carving, painting, staining, gluing or fastening mouldings.

Redwood screens do not shrink or warp out of joint, and they have a high resistance to rot, whether exposed to the weather or to conditions that would promote dry rot.

Fireless Cookers

The non-conductivity of Redwood, together with its ability to make a tight joint, and hold the joint regardless of the difference in temperature between the interior and the exterior of the fireless cooker box, are qualities that give Redwood a decided preference for this use.

Its light weight, easy working, perfect surface to paint, and its durability are also favorable factors.

Manufacturers of fireless cookers can buy Redwood to advantage because it can be furnished cut to the sizes required at a material saving compared with buying regular stave lengths.

Stakes and Fence Posts

Because of its wonderful durability in contact with the ground there is no wood like Redwood for stakes and fence posts. It is used almost exclusively in the vineyards and ranches of California.

Enormous quantities of Redwood stakes are set annually in the vine-yards and hop fields of California. These stakes are split and come in two sizes, 2 x 2 in, and 6 ft. and 2 x 2 in,—8 ft.

Redwood split posts come standard 4 inches by 5 inches and 7 feet long. Sawn posts come in lengths of 6 feet, 7 feet and 8 feet, and 3 inches by 4 inches, 4 inches by 4 inches and 4 inches by 6 inches.

The wonderful durability of Redwood in contact with the ground was recognized by the Lincoln Highway Commissioners of the west when they selected Redwood for marking posts for that part of the roadway between Salt Lake City and San Francisco, a distance of 1000 miles. Each mile of this distance is to be marked with a Redwood post.

The Highway Commission had before it a proposition to mark this highway with boiler tubes set in a concrete base, but it was found that, in addition to the expensive settingup cost the boiler tubes could not be guaranteed to stand as long as the Redwood post, which, without any attention, is good for 25 years and upward.

The overland traveler in an automobile is therefore welcomed to California by a thousand miles of Redwood posts that guide him to the land of "big trees," golden rivers, and the most wonderful lumber in the world—Redwood.

CALIFORNIA REDWOOD

Bee Hives

Redwood is without question the best adapted wood for bee hives.

Its light weight, easy working and its ability to hold tight joints regardless of alternating conditions in the atmosphere, as well as its durability without protection of preservatives, make it a material which, when used in the bee hive, can be depended upon to last a life-time.

Redwood is odorless and tasteless and has no deleterious effect on the honey.

Bee hive stock in Redwood is obtainable in cut lengths according to specifications desired.

Fruit Trays

In the great fruit-growing sections of California the Redwood tray is used for sun-drying fruits. These trays are made of Redwood. They are set on the ground with the fruit in them, and are thus exposed, during the curing process, to the hot rays of the sun.

Setting on the moist ground they are naturally subjected to curling or warping on account of the conflicting strain set up in the fiber of the wood by the varying degrees of dryness on both sides—and Redwood stands this strain without sacrifice of shape.

In addition, Redwood is light and easy to handle.

Cigar Boxes

Redwood is rapidly finding favor among manufacturers of cigar boxes as a suitable wood for this purpose.

In strength and color it compares favorably with cedar, and is odorless.



A Redwood cigar box

Redwood possesses the remarkable quality of "staying put" when properly dried, regardless of atmospheric or climatic changes or conditions, and holds labels perfectly.

Cigar box stock should be vertical grain, thoroughly dry and clear. It is furnished either in flitches, or cut to special size for immediate use.

Bill-Board Moulding

Redwood is recognized by the bill posters of the United States as superior for bill-board moulding.

Bill-boards are exposed to rough weather, and the essentials, therefore, are a lumber of great durability under varying climatic conditions, as well as a surface that takes and holds paint perfectly.

Redwood meets all these require-

ments.

Redwood is the most durable lumber for bill-board purposes. It is light in weight and easy to work. It does not rot because of dampness between the moulding and the bill-board.

For posts and backing Redwood will last longer than the sign-board itself.

Redwood bill-boards require less up-keep attention and cost.

Lead Pencils

The rapidly diminishing supply of cedar for lead pencil stock is causing the pencil manufacturers to look for other suitable woods, and they find Redwood adaptable.

It not only closely resembles cedar in color, but a vertical grain Redwood pencil can be sharpened as readily as a cedar pencil.

Redwood pencil stock, to be entirely satisfactory, must be carefully selected as to grain, softness and the number of annular rings.

It is light in weight, can be thoroughly dried, and is a splendid wood to glue.

Pencil manufacturers in this country have been using Redwood for many years, and large quantities are shipped abroad for this purpose.

Redwood Burl

Burl is not lumber—it is a lump growth on the exterior of the tree, usually covering a wound.

Large quantities of burl are used for novelties, such as pipe trays, plates, bowls, etc., and these in many instances have left the impression, particularly in the east, that burl is Redwood.

Burl is gnarly, plentifully spotted with small knots, hard, and takes a high polish in imitation of mahogany.

Burl does not grow on all trees, and, as a result, it is very scarce. This scarcity, together with the big demand from novelty manufacturers, keeps it at a big premium in the market.

Camera Stock

The light weight of Redwood, its ability to make and hold a tight joint, and the absence of shrink, swell, or warp, regardless of atmospheric or climatic conditions, combined with its easy working quality, make it especially adaptable for camera stock.

Redwood also lends itself splendidly to firm gluing of camera covering.

Redwood camera boxes can always be depended upon to remain lightproof, and thus insure perfect service by the camera.

RESISTS FIRE AND ROT

Toys

The manufacturers of toys are turning to Redwood because it not only affords a sentimental factor that is a powerful influence in its sale, by reason of the fact that it is wood from the "big trees" of California, but also because it is splendidly adapted to such purpose.

It has light weight, smooth even grain, will not swell or curl, is easy and profitable to work and has a

bright, warm color.

Redwood toys are not only a diversion, but an education to the child by reason of the fact that they awaken an interest in the "big trees"—a subject that is familiar to every school child in the nation.

Park Equipment

For benches, gutters, and curbing, plant stakes, planking, etc., because of its natural durability in contact with the ground, Redwood is the wood to use.

It is universally used in the parks in the western section of the country, where Redwood is so well known.

Enormous quantities of Redwood were used for this purpose in both the Panama-Pacific International Exposition in San Francisco in 1915, and the Panama-California Exposition in San Diego in 1915-1916.

Redwood's adaptability to paint makes it particularly preferable for park benches and settees, pergolas, porches, etc., where the building material must not only have durability but a natural resistance to the weather.

Because it does not warp and swell Redwood is preferred for grandstand benches and bleacher seats at baseball parks and athletic grounds.

Redwood park equipment insures long life at a minimum cost.

Ship Interiors

Redwood has been used for many years as interior finish and cabin par-



S. S. "Secandbee" of the Cleveland and Buffalo Transit Company, the largest side-wheel ship in the world. The staterooms, partitions, etc., and the canvas-covered decks are of California Redwood

titions on passenger ships, both in this country and in England, where millions of feet of Redwood "bulkheading" have been installed on fast Atlantic liners.

It is superior for ship interiors for these reasons—

- Its resistance to fire, and ease in extinguishing when afire.
- Lack of shrink, warp, or swell due to changes in temperature or climate.
- 3. Redwood always looks well it "stays put."
- 4. Resistance to wet or dry rot.
- 5. Its extremely light weight makes it preferred for superstructure in boat-building, where the center of gravity is an important factor.
- It is a perfect surface to take and hold paint, stain, or enamel.
- 7. It has splendid adaptability for decorative effect, because of its smooth surface and straight grain. Wonderful panel effects can be achieved in cabins by the use of stain or sandblast.

Pattern Stock

Manufacturing institutions on the Pacific coast have used Redwood for pattern stock for many years.

Thoroughly dry Redwood can be depended upon to make a satisfactory joint; it is easy and profitable to work, and is not affected by variation in atmospheric conditions from moisture to dryness. It can be depended upon to hold its shape.

The pattern makers in the east are turning to Redwood because of this last characteristic, and because it is thoroughly satisfactory to work.

Pattern lumber should be selected

for soft even grain, and it must be thoroughly dry before using. In addition to the clear grade many pattern makers use a selected high grade of "shop" lumber which costs considerably less, and in no way affects the value of the finished pattern.

Veneer Core

The porosity of Redwood makes it absolutely dependable as veneer core.

The holding quality of a core depends upon its absorbing power or anchorage for glue. Kiln-dried Redwood is a perfect gluing surface.

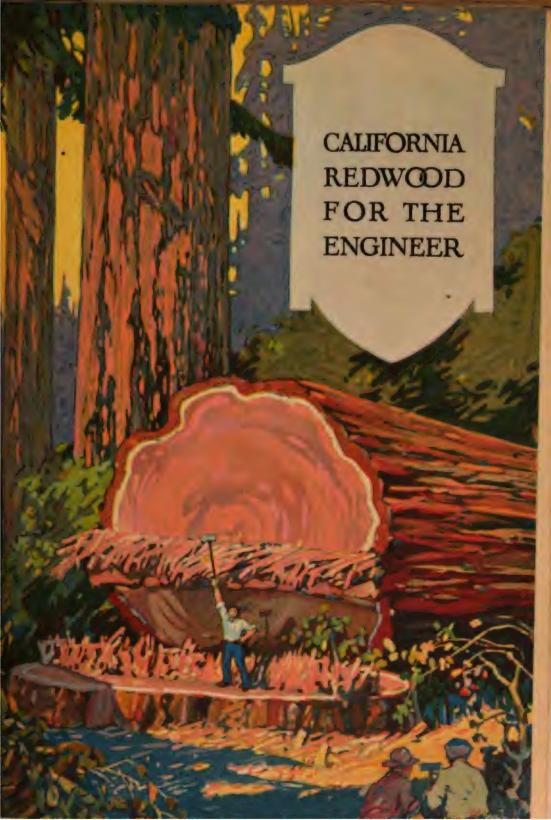
In addition to Redwood's light weight it does not deteriorate by dry rot, even when denied ventilation. It is virtually immune from the attack of insects.

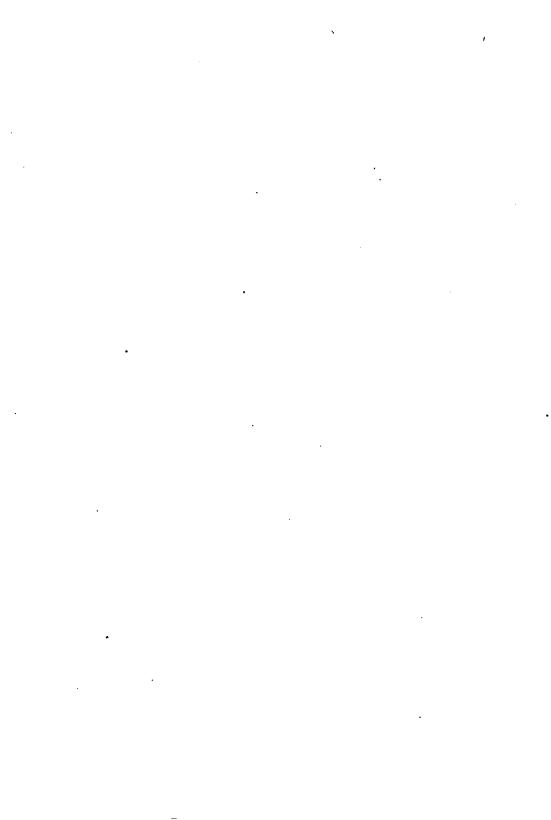
Thoroughly seasoned Redwood does not shrink, swell or warp, and the core will always hold its proper shape. A Redwood core is not affected by sudden changes in temperature or climatic conditions, and therefore, holds the veneer from moving from the same causes.

Manufacturers using veneer in large quantities have thoroughly investigated Redwood as a core, and find it meets all requirements, and particularly for such fine work as pianos, desks, furniture, hardwood veneer doors, panels, and so forth.

Veneer core stock is furnished in Redwood in small pieces cut to size. rough or built up stock.

A manufacturer of canoes in the east is using Redwood cores between birch veener for canoes. After considerable experimenting he finds that Redwood is perfectly adaptable to this use for the reason that the porosity of the wood affords a perfect surface to glue, and also contributes to lightness.





ROPERTY OF DIVISION OF

FORESTRY

COLLEGE OF A AGRICULTURE

CALIFORNIA REDWOOD FOR THE ENGINEER



CALIFORNIA REDWOOD ASSOCIATION
SAN FRANCISCO

Copyright, 1917 by California Redwood Association



Station of the Northwestern Pacific R. R. at Willits, California. Built throughout of California Redwood

Engineering and Railroads

EDWOOD'S resistance to rot is recognized as standard by railroad, mining, and construction engineers, and Redwood is extensively used by them for a great variety of such purposes. It is specially suited for tanks, pipe lines, flumes, timbers, irrigation and drain boxes, concrete forms, lagging, etc.

Railroad Uses

Some of the many railroad uses for Redwood are:

FOR EQUIPMENT

Refrigerator Car Roofing. Stock Box and Metal Covered Roof.

Siding for Freight Equipment.

Siding for Outside Frame Box Cars.

Baggage and Express Moulding, Casing, Lining, and Sheathing. Passenger Equipment Car Bottom Lining.

Inside Lining for Freight Equipment Cars (except refrigerator cars).

Lining and Ceiling for Refrigerator Cars.

Passenger Car Outside Sheathing and Panels

Letter Boards.

Moulding.

Postal Car Lining and Ceiling.

Baggage and Express Car Ceiling.

Eave Facia Moulding.

WILL NOT SHRINK, SWELL OR WARP

ADDRESSED TO: Hobert Building, San Francisco.

SOUTHERN PACIFIC COMPANY.

OFFICE OF CELLS INGINISES.

1136 James Flood Sldb., San Francisco, Calif. February 10th, 1917.

Mi. J. P. Browne, Vice President, Pacific Lumber Co.

Torr 31r:-

Southern Pacific Company uses redwood ties by preference to may other ties available on the Pacific Coast.

Our ordinary consumption is from 750,000 to 1,000,000 redwood ties per year, perhaps an avarage of about 900,000 for maintenance of track (tie renewals).

With Southern Pacific Company rolling stock in use at present the always tie plate redwood ties, and also tie plate other ties, excepting on unimportant branch lines.

Some years 'go when the weight on engine driving wheel exles 'wee about on -half what it is now, we did not tie plate redwood ties.

The life of redwood ties in track is variable as affected by decay, dependent upon the local conditions, character of soil and prinfall, etc., but the redwood tie under any conditions is the most durable tie available here.

I have known redwood ties to be in use in main line track as long as 22 years, so the average redwood tie under all conditions can be relied on with us for about 12 years, perhaps more.

Yours respectfully,

Chief Engineer, Southern Pacific Company.

Redwood tie is most durable



NORTHWESTERN PACIFIC RAILROAD COMPANY

W. B. PALMER
PRESENT AND SENSORS, MARAGES.
PRESENT BUSINESS. SAN PRASSECT.

(COPY)

April 29, 1914.

Mr. Junius H. Browne, General Sales Manager, The Pacific Lumber Company, Exposition Building, San Francisco.

Dear Sir:

Practically all of the tracks of the Northwestern
Pacific Railroad Company, some 500 miles, are laid with redwood
ties. Many of the ties which were used in the original construction of the lines ultimately consolidated into the Northwestern Pacific, were in the track 18 to 20 years before removal.
When built, 50 and 56-pound rail was laid upon these ties
without tie plates. Upon tangents and upon branch lines where
the traffic was light, some of these ties were taken out of the
track at the end of 25 years practically sound so far as decay
was concerned. However, through adzing on account of outer rail
of curve rolling, and frequent re-spiking for gauge, the ties
had become useless.

In 1908, the Morthwestern Pacific replaced old 56-pound steel between Cloverdale and Ukiah with heavy rail, and at that time many of the ties replaced were those laid in this track in 1889.

At present, the Northwestern Pacific is using a 6 x 8° redwood tie, with Harriman Lines' flat tie plate, 8 x 8½°, weighing 6.36 pounds, and believe that such ties will give from 12 to 15 years of service except where laid on sharp curves. We are operating over this track ten-wheel engines with driving wheel load of 134,000 pounds, total loaded weight of engine, 176,000 pounds and the tie plates in five years have no more than bedded themselves in the tie.

Considering the durability of the wood, and with proper tie plate protection under rail of adequate weight and size for the power used, we believe a redwood tie of the size above mentioned gives better service than a 7 x 9" tie of less durable woods.

Yours truly,

(Signed) W. S. PALMER.

Life of Redwood ties 18 to 25 years on this road



Interior of railroad station at Willits, California. Finished with Redwood

BRIDGES, CULVERTS AND TRESTLES

Foundation Timbers. Cross Ties for Bridges. Mud Sills. Trestle, Caps, Posts, and Sills. Cribbing. Posts.

MOTIVE POWER

Lagging for Locomotive
Boilers.
Boxing, Temporary Grain
Doors and Ordinary
Work.
Cabinet.
Office Case Work, etc.
Patterns.
Inside Finish in Buildings.

Window and Door Facings.
Sign Boards.
Wide Mouldings.
Sash.
Cabinet Work.
Insulating Boards and Wall.
Ceiling of Refrigerator and
Freight Cars.
Passenger Car Ceiling.
Stripping for Powder Cars.

ROADWAY

Ties.
Fence Boards.
Flumes.

POSTS

Line and Lamp Posts (Electrical Dept.). Fence Posts. Sign Posts. Signal Posts.

Cornices.



Views of railroad station at Willits, California, showing Redwood construction details



The beautiful interior of the city ticket office of the Santa Fe Ry. at Los Angeles. All Redwood and a striking example of the exquisite decorative effects possible with this remarkable wood

BUILDINGS

Ceiling.
Foundation Timbers.
Sheathing and Underflooring.
Wainscot.
Shingles.
Barn Siding.
Drop and Lap Siding.

MAINTENANCE

Cribbing. Finishing Lumber. Signs.

WATER TANKS

Staves and Bottoms.

SIGNAL DEPT.

Trunking and Capping

Redwood does not have to be treated with artificial preservatives to prolong its life. Nature impregnated Redwood with a natural preservative that grew into the wood. For engineering purposes in contact with ground or moisture, Redwood can be depended upon to maintain its full strength and service from 15 years upward.

Redwood Railroad Ties

The hardest possible service to which wood can be subjected is the railway tie.

It is not only in constant contact with the ground, but it must stand the strain and stresses of swiftly-moving heavy trains. In his report on "Timber; An Elementary Discussion of the Characteristics and Properties of Wood," to the Division of Forestry, U. S. Department of Agriculture, Filbert Roth, special agent in

CALIFORNIA REDWOOD

charge of timber physics, gives the following table on

THE RANGE OF DURABILITY IN RAILROAD TIES

YEARS
Redwood12
Black Locust10
Cypress and Red Cedar 10
Oak (white and chestnut). 8
Chestnut 8
Tamarack 7 to 8
Cherry, Black Walnut
Locust 7
Elm6 to 7
Long Leaf Pine 6
Hemleck4 to 6
Spruce 5
Red and Black Oaks 4 to 5
Ash, Beech, Maple 4

To get best service out of the Redwood tie under heavy equipment tie plates should be used.

Redwood ties are in big demand in South America, England and the

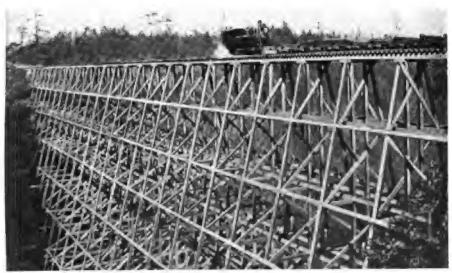
continent, Australia and the Orient, because of its resistance to decay and resistance to attack of destructive insects so common in the tropical countries.

Car Siding, Stations, Etc.

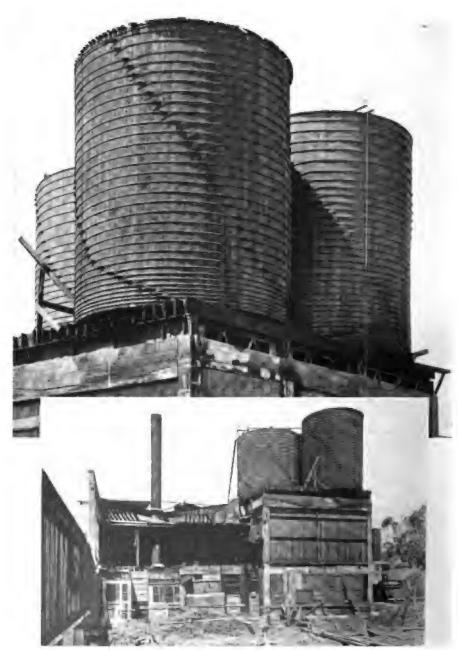
Redwood is splendidly adapted for car siding and roofing because it is sufficiently strong, light in weight, does not shrink, swell or warp, is hard to set on fire and burns very slowly, is not subject to wet or dry rot, and takes and holds paint perfectly.

The absence of shrink or swell is particularly desirable for car siding and roofing because of the travel of the car through varying climatic conditions.

Redwood is generally specified for railroad stations in the western country because of its extreme durability in contact with the ground and exposure to the weather, its satisfactory painting surface and its fire resist-



Railroad trestle, 640 feet long and 144 feet high, built entirely of Redwood



Redwood water tanks are capable of withstanding severe fires, as evidenced by above photographs. The two charred tanks are Redwood, and went without damage through the fire which destroyed the plant of J. Allec, New Parisian Dyeing and Cleaning Works, San Francisco. The third tank of another wood had to be entirely replaced

CALIFORNIA REDWOOD

ance. Redwood is specified for such work to reduce the upkeep cost on small stations.

Tanks and Vats

Redwood makes a superior stave for tanks.

Redwood is a non-conductor of heat and cold; 2 inches of Redwood is equivaent in insulating power to approximately 30 inches of steel or concrete. This is an element of high importance in the stave for this use because it preserves the temperature of the contents of the tank.

Redwood staves are made from clear heart straight-grain stock and come in standard sets of 6 to 9 and 10 to 20 feet in length.

Redwood's long life and its resistance to decay or corrosive acids and alkalis make it extremely valuable for tanks. Redwood tanks can handle muriatic acid solutions up to 6 per cent, and up to 28 per cent of nitrohydrochloric acid.

Redwood tanks are used in copper mines, where strong solutions of destructive acids are necessary in refining processes; in chemical works, tanneries, breweries, soap factories and other manufacturing processes where the tank is called upon not only to stand up under years of service, but remain unaffected by the contents. There are thousands of Redwood tanks in use for water storage, in wineries, for oil, fire protection, railroads, etc.

Redwood tanks, as well as pipe, are not injured or affected by arid climates or extremes of temperature. Redwood wears evenly under all sorts of service.



Redwood vats at plant of the Krieg Tanning Company, San Francisco, in service since 1852. Note the bored Redwood feed pipes to carry solutions used in the tanning process



Some machine banded wire wound Redwood pipe

Pipe and Flume

For pipe and flumes there is really no competition with Redwood, where permanency in installation and the highest type of service are demanded.

Redwood makes a superior stave for pipe. There are many Redwood stave pipe lines in operation today that have been in continuous service from 20 to 30 years, and show, under careful examination, no appreciable signs of decay. The average life of Redwood stave pipe is not definitely known. The original installations made in 1886, 1889, and succeeding years, are still in practically as good condition as when installed; and it is fair to assume that the ultimate life of a well-built Continuous Stave Redwood pipe is from 60 to 75 years.

Redwood is a non-conductor of heat and cold; 2 inches of Redwood

is equivalent in insulating power to approximately 30 inches of steel or concrete. This is an element of high importance in the stave for this use because it preserves the temperature of the contents of pipe.

Redwood staves are made from clear heart straight-grain stock and come in standard sets of 6 to 9 and 10 to 20 feet in length.

On large installations the cost of Redwood pipe is about one-quarter the cost of cast iron, and from 25 to 33 per cent less than steel. At the prevailing price of cast iron pipe (in May, 1917) a 24-inch Redwood pipe line would cost about 25 per cent of a cast iron line of the same size, while a 60-inch cast iron pipe line would be entirely out of the question, as cast iron pipe is not made in that size.

Redwood pipe is used as main

lines for municipal water plants, penstocks for hydro-electric plants, in mines where drainage water is not only hot, but carries mineral and chemical solutions detrimental metal and other kinds of wood pipe: for sluicing, conduits, sewerage disposal, irrigation systems, etc.

Redwood pipe installations are made from 2 inches up to 13 feet in diameter. It is made in two forms-"machine banded" and what is known as "continuous stave" construction.

"Machine banded" pipe is made in completed sections, in standard length of 6 to 20 feet, from 2 to 32 inches in diameter, and is shipped ready to be laid.

"Continuous stave" pipe is a builtup installation, and is usually used for lines above 20 inches in diameter and up to the largest size. It is shipped to the installation as staves. The stave arrangement is staggered, and the ends splined. This gives a continuous pipe line that is best adapted for long lines conveying large volume of water.

"Continuous stave" installations can handle, in large pipe a pressure head of about 350 feet, and in smaller diameters it can be installed with strength sufficient to carry 400 feet head. "Machine banded" pipe can be made with a guarantee to withstand a static pressure of 800 feet. There are lines in Nevada carrying 500 feet head, which is 216 pounds to the square inch.

Redwood pipe in service and cost offers these distinct advantages over

Costs less than any other pipe of equal efficiency.

Has a life equal to any other pipe ex-

cept cast iron.

Will survive many replacements of steel hoops or wire bands even when the hoops or bands are heavily galvanized or coated with asphaltic.

Carries from 10 to 20 per cent more water than any other kind of pipe when both are new, and from 30 to 50 per cent more when both are 10 years old.

Flow capacity is not interfered with by accumulation of blisters and other foreign matter on the inner walls, such as in metal or concrete pipe, and which accumulation decreases the flow by increasing friction.

Not affected by electrolysis.

Not attacked by worms or insects, in-cluding the notorious white ant of the tropics.

Not affected by soils, which in many in-stances destroy other pipe.

Will not freeze under a temperature that bursts a metal pipe. If the water freezes, the flexibility of the pipe will prevent burst-ing. It neither expands nor contracts with heat or cold, therefore does not require expansion joints.

Not afflicted with temperature cracks such as occur in cement or concrete pipe.

Water is not discolored, stained or tainted, and it remains cool even when the pipe is laid on the surface in hot climates.

Redwood is a non-conductor of heat, and hot fluids and hot water can be pumped through it with a minimum of radiation.

Easily transported, particularly in rough or mountainous country, in "knock down"



A Redwood standpipe in the Rocky Ai ountains

A Redwood pipe is the highest type of service durability. As the durability of Redwood staves is 5 or 6 times that of naked steel hoops, it is usual to protect hoops with asphaltic or other protecting coatings. There is no definite rule as to the life of the steel band on a Redwood pipe. That depends entirely on the character of the soil that the pipe lies in. If it is salty it will attack the steel much more quickly than an installation in clay. In making Redwood - pipe installations, the pipe companies investigate the bed for the pipe very thoroughly and the pipe is equipped with protected hoops to give it the maximum life.

Irrigation Boxes and Head Gates

Irrigation boxes and head-gates are built of Redwood, to get the Redwood service in long life.

The same applies to drainage and sluice boxes.

Redwood is being successfully used in California instead of porous tile to drain farm lands. This is usually done by making a 3-sided box of 1 x 12-inch boards, and setting the open side down. In this use it will last 15 years or more.

Read the experience of a practical farmer:



This Redwood pipe line operates under a head of 100 feet, and was installed for the city of San Diego, California



Redwood irrigation boxes in California

STANDISH & HICKEY LTD. San Francisco, Cal., July 7, 1916.

EDWIN E. MYERS, ESQ., Sec'y California Redwood Assn.,

51 Newhall Building, San Francisco. DEAR SIR:

Referring to yours of July 6th, regarding use of Redwood boxes for drainage on my ranch-

I have found it profitable to use Redwood boxes in several thousand feet of drains. The ditches are about five feet deep; the soil is of such character they would rapidly fill unless tile or some substitute was put

Knowing the lasting qualities of Redwood in the ground, we have put in boxes, without bottoms, using a No. 2 grade of common Redwood, without sap.

The interior capacity of the boxes would run from 36 to 100 square inches.

The cost of this box, compared with tiling, is far cheaper, and, of course, the boxes can be much more expeditiously laid. Respectfully yours,
MILES STANDISH.

The great durability of Redwood in contact with wet ground, in addition to its light weight and ease of working, puts it, as far as the California country is concerned, in a class without competition for this purpose.

Concrete Forms

For concrete form lumber Redwood is exceptionally valuable because it does not curl or shrink, and can be used over and over again.

This is particularly true in hot climates where the sun, beating against the outside of the concrete form, warps other lumber by drying the exterior faster than the inside of the form board that is next to the wet concrete.

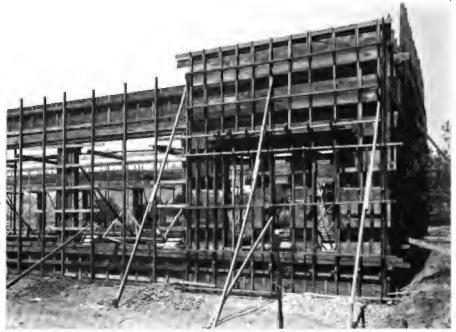
It has been found by actual experience with Redwood for concrete form lumber that---

It strips better.

Can be used over and over because it does not change its shape.

It is easier and cheaper to handle by the carpenter.

By tonguing and grooving the form lumber better results are secured, giving a tighter form and a smoother concrete job.



Redwood makes the finest kind of lumber for concrete forms because it does not shrink or curl.

Redwood forms increase contractors' prefits. Rubber tire plant of

V. K. Sturges Co., Onkland, California

Redwood is particularly recommended for wall and floor work.

For building residences, where concrete foundations are provided, a big saving in the construction cost is possible by using Redwood boards for the concrete forms for the foundations and later using the same boards for sheathing the house.

It has for years been the universal practice of contractors to use Redwood for concrete forms in "footings," for pillars, etc., where the lumber is left in the ground and where Redwood will last indefinitely without rotting.

The following letters from contractors testify as to the high regard in which Redwood is held as a concrete form lumber:

GILDERSLEEVE CONTRACTING CO. NAPA, CAL.

CALIFORNIA REDWOOD ASSN., San Francisco, Cal.

Your letter of February 9th received and you wish me to give you my reasons for preferring Redwood to . . .

lumber for concrete work. I have always used . . . lumber for all my work until last year, and for a part of my work I used Redwood and . . . mixed. I found that the Redwood stripped in much better condition than the . . . and were troubled very little from warping, while the . . . could hardly be used after lying in the sun for three or four days. I used the Redwood over four or five times and it was in better condition than the . . . after it had been used twice. We have very little trouble with Redwood warping after it is nailed in the forms; also the carpenters will work more Redwood than

CALIFORNIA REDWOOD

I employed Messrs. Bardwell & Zimmerman, of Calistoga, to frame my bridges at Ukiah last year. A few days ago I met Mr. Bardwell and he said the experience he had while on our job had thoroughly cured him from using . . . lumber for concrete; no more . . . for him for concrete building.

You may be sure in the future I shall give Redwood the preference, even if it should cost a little more; it might take a few more stiffeners, but it is cheaper in the end. Yours truly,

GILDERSLEEVE CONTRACTING CO.

CHRISTENSEN BROTHERS OAKLAND, CAL.

California Redwood Assn., San Francisco, California.

Gentlemen: In answer to your inquiry of recent date as to why we used Redwood lumber for concrete forms on the Sturges Tire Factory in Oakland, California, we wish to state that it was the first job upon which we had done so and it was experimental with us.

We had often spoken of Redwood for concrete forms, primarily because it was easy to handle and soft for nailing, and we thought that after stripping it could be used a second or third time.

We are very pleased to say that the experiment far exceeded our expectations. The walls were twenty-two feet high and two hundred and eighty feet long, and after stripping we found no stains at all in the concrete walls and when the alkali came to the surface it shone as white and clear as any that has ever come through after using pine lumber. The dampness on one side and the exposure to sun and air on the other seems to affect the lumber very little, and causes no warping as in other timber, thereby giving a smaller percentage of waste.

For the above reasons we feel that in the future we shall use nothing but Redwood for forms, unless specified otherwise by the architect. Very truly yours,

CHRISTENSEN BROS., C. Christensen.



Redwood concrete forms on big construction work



Main Street bridge, Willits, California. The rot resistance of Redwood makes the floor and joist construction of this bridge good for many years. The floor joists are 3 x 16 "merchantable" Redwood; the rough flooring 2 x 8" "construction" Redwood; and the finished flooring is 2 x 3 "merchantable" Redwood. For a wearing surface the bridge is finished with road oil and screenings

Gutters, Curbing, Etc.

Large quantities of Redwood 3" x 12", merchantable grade, are used in California for curbing and gutters in street work.

It is extremely durable in this service, lasting from 15 to 20 years, and particularly useful for outlying sections of big cities and in small communities.

For lining cesspools, culverts, subsurface drains, sumps, bulkheads, lagging, etc., Redwood can be depended upon for from 15 to 25 years of usefulness.

Many small communities find it to advantage to use wooden gutters and curbing where stone is not available. Most any other kind of wood for this service has to be creosoted, while Redwood can be put down just as it is taken from the lumber yard. It contains its own natural preservative.

Sheet Piling

Redwood's durability in contact with the ground makes it especially valuable for sheet piling. It is used in the west almost entirely for this purpose where driven in soil or sand.

It is sufficiently strong for this purpose, and, when once placed, it can be depended upon to last from 25 years upward, regardless of the condition of the soil or moisture. Redwood is so constituted by Nature that it has an equal resistance in almost any type of soil.

In the western country where drains, flumes, dams, sinks, septic tanks, bulkheads, sumps, etc., are common on every ranch or farm property, Redwood is always used because the first installation is regarded the final cost, not only in money, but in time and attention for

many years.





OAKS OF PACIFIC SLOPE

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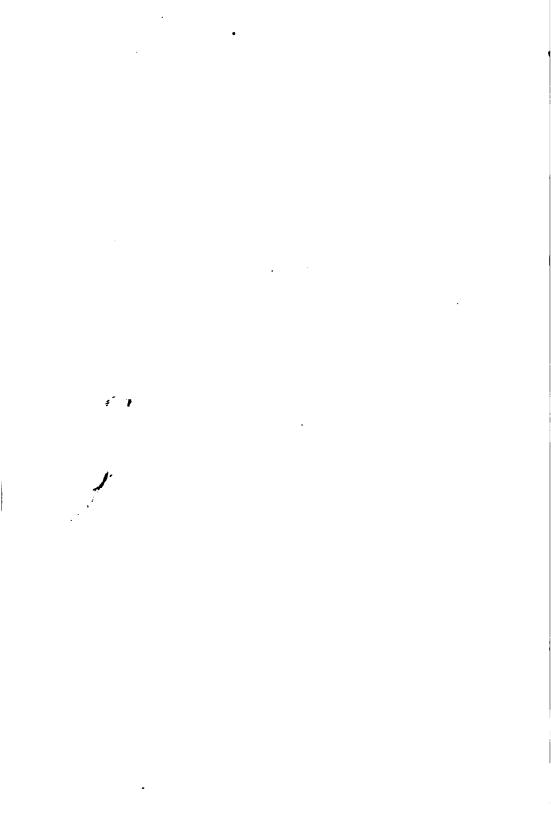


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ground to the exclusion of predecessors and newcomers. The oak thus replaces the pine, to the surprise of some observers, and continually, as the pine forests of the eastern states are cleared away, the rugged black oaks, often the little, worthless scrub oaks, seize upon the dominions.

Forests of oak extend thus into the naturally treeless western portion of the Mississippi Valley, reclothing the prairies and the partial deserts, welcomed and protected by the settlers. The kind of oaks that survive most in forests of many species is not, generally, the most valuable,—the white oak group,—but the coarse-grained, usually worthless black oaks. And this is accounted for very readily; the bitter, astringent qualities of the acorns of the black oaks are left by swine, squirrels, and birds alike, to germinate, while they hunt industriously for the sweet, nutritious acorns of the white oaks.

VALUABLE PRODUCTS.

The family of oaks, comprising the botanical genus of Quercus, is distinguished, not only for their generous shade, owing to their usually large and numerous leaves, but several of the arboreal species of white oak are celebrated as timber trees. Of these the most valuable in various manufactures are Quercus alba, the white oak of the northern states, Q. virens, or live oak of the southern states, and the Q. platanoides, or white oak of the middle western states, while others, including the Q. densiflora, the tan-bark oak of the California coast, are prized for the yield of bark collected by the ton annually for making leather. One peculiar species, Q. suber, the cork-bark oak of southern Europe and northern Africa, yields the soft, spongy bark from which is derived the cork of commerce. Also from early times oak galls caused by the punctures of insects, have been used for dyeing, for making ink, and, indeed, for wound-dressing and for medicine.

DISTRIBUTION.

While many species of oak are doubtless unknown, from the nature of the regions they affect (the high, broken mountain slopes, mostly unexplored), there have been discovered and described over three hundred species.

Europe has comparatively less than similar regions east and west of it. The number in North America north of Mexico already known, is about fifty. The American species are mostly grouped in two regions,—the eastern Atlantic slope and the extreme western Pacific slope.

Of the eastern oaks three species—the red oak, the bur oak, and the white oak—are found at the northern limit in northwest Ontario.

Southward the species increase to ten in southern New England, while the gulf states contain some nineteen species; but the central eastern portion of the Mississippi Valley contains more individual trees to the acre—and they attain the largest size there—than elsewhere in America.

Leaving the prairies and approaching the high, dry, and cold midcontinental plateaus, the oaks—even the dwarf varieties—are almost entirely absent.

PACIFIC SLOPE A UNIQUE REGION.

The Pacific slope of North America comprises, of course, all that part of the continent west of the Rocky Mountains; but for the purpose of this paper, only the American portion north of the Mexican boundary will be considered. This region includes two territories, five states, and a portion of three others. It happens that this large region, owing to the continuity of the high Rocky Mountain range—without a break or low pass from the Arctic Ocean to the Gulf of Tehuantepec—is possessed of a practically distinct flora. Not a pine, spruce, fir, cedar, or cypress, not an oak, ash, walnut, or maple of the Pacific slope, is identical with those beyond the Rockies. So we have here a compact, definite, and nearly special creation.

Because the Mexican boundary is not a high mountain range, but only a straight surveyor's line across a continuous plateau, the floras of Mexico and the United States commingle here, five Mexican oaks dripping over the line into New Mexico and Arizona. Three local species arise there, too, sharing the highlands with them; but from thence northward, inhabiting the humid, forcing climate of California and Oregon, to Washington and British Columbia, the thirteen species are all our own,—the largest and noblest of them being in the great valley of California.

PRINCIPAL PUBLICATIONS OF AMERICAN OAKS.

"Sylva of North America," a fine quarto volume, was published 1817, by Andrew Michaux, as the result of the explorations of his father and himself in the then little-known region of America. It contains descriptions with excellent colored plates of the foliage and fruit of twenty-six species of oak inhabiting the region east of the Mississippi River. The continuation of the Sylva, 1857, by Thos Nuttall, added four more, all from the Pacific slope; Quercus agrifolia, our first discovered, storm-beaten Live Oak; Q. lobata the noble Valley Oak; Q. Garryana, the fine Pacific white oak; and Q. dumosa, the low, Bushy Scrub Oak, or chaparral.

"The Oaks of the United States," a scholarly paper, read 1876

before the Academy of Sciences at St. Louis, Mo., by Dr. Geo. Engelmann, described forty species, including nine more western ones. In 1880 Dr. Engelmann elaborated the genus *Quercus*, the oaks, in Watson's second volume of "Botany of California." It included descriptions of eleven western species. No illustrations accompanied either of these papers.

"Forest Trees of California" appeared 1882, published by Dr. A. Kellogg, one of the seven founders of the California Academy of Sciences. It includes seven species of oak, lovingly described by the doctor in appreciative but non-scientific language, interspersed with poetical quotations. For many years afterward, Dr. Kellogg devoted odd hours to accurate drawings of oak branchlets—the foliage, flowers, and fruit—which were utilized by a later author.

"West American Oaks," appearing 1889, is a folio volume in two parts, by Prof. E. L. Greene, then of the University of California. The first part is a memorial tribute to the labor and worth of Dr. Kellogg, the illustrations being those cited above as the painstaking work of the doctor. The species, seventeen in number, include *Quercus Morehus*, of Kellogg, and a new and tenable species described under the name of *Q. Engelmanni*.

Dr. Kellogg's drawings of species outside of California were made from specimens collected in Arizona and New Mexico by the writer, as noted by the pencil of Dr. Kellogg and the pen of Professor Greene. The second part presented several proposed new species, illustrated by drawings by Geo. Hanson.

"Forest Trees of North America," being vol. 9 of the Tenth Census of the United States, appeared 1884, by Prof. C. S. Sargent, director of Arnold Arboretum. This large folio volume contains extended discussions of trees from many points of view, describing forty-eight oaks, sixteen of them inhabiting West America. No illustrations.

"Arborescent Flora of the United States" is the title of a classified list or bulletin from the Agricultural Department at Washington, issued 1897, by George B. Sudworth, dendrologist of the Division of Forestry. The publication of this painstaking list gave Mr. Sudworth the opportunity to apply the new rules of priority in the presentation of names, whereby he becomes the author of scores of new designations of well-known trees, including Sequoia Washingtoniana, for our Giant Sequoia.

This volume was followed, 1898, by a Check List of United States Forest Trees, their Names and Ranges, including seventeen species of oak from West America.

Latest and most extensive of all is the "Sylva of North America," by Prof. C. S. Sargent. This is a series of twelve magnificent folio volumes, which began to appear in 1891. The seventh volume, published 1895, treats of the Cupuliferae, including the oaks. With elaborate descriptions and foot-notes of each species and ample illustrations of the foliage, flowers, and fruit, these twelve ponderous volumes, comprising all the American trees known, must long remain the most valuable treatises upon the subject,—a conspicuous and fitting monument to the industry, erudition, and perseverance of their author. There was but a limited edition printed, the sets costing to universities and public libraries twenty-five dollars per volume. Sargent describes fifty species of oak, twenty-one of them in West America.

No illustrations of entire trees or lower portions of tree trunks—as instructive in this as in the conifer family—are given in any of the works above cited. In time the public will demand a fully illustrated work, especially of our western trees, at once a supreme delight to the eye and affording a complete comprehension by the mind of the beauty and value of these master products of the earth.

The varying number of western oaks described in the nine volumes cited—ranging from four species in Nuttall's Sylva to twenty-one in Sargent's—indicates not only the advance of discovery in forty years, but also the varying number of characters deemed necessary for specific rank by different botanists, some requiring more than others.

In general, Professor Greene is very radical, often publishing new species on a few characters, while Professor Sargent is conservative, often uniting many forms under one general description.

THE OAKS, A MEMORIAL FAMILY.

The oaks may well be called the memorial family; no other genus of plants of the same number of species has so many in it named for persons. There is good reason for this. The species are so widely distributed through the north temperate regions, the very regions inhabited by persons of appreciation, and they are usually so beautiful and long-lived, that they speedily become well known and great favorites; hence, it is a high honor to have a species of oak named for one by a fellow-botanist.

The whole number of species of oak in the United States is fortythree; the number named for persons (the discoverer or one who has studied them closely) is fifteen. The number on the Pacific slope is twenty-one, of which more than half (twelve) are memorial oaks.

In the descriptions following (this being more a popular than a scientific treatment of the subject), some attention is given to the dis-

coverers and describers of species; in some instances, brief biographies are presented.

The writer, although he has explored the Pacific slope for many years, collecting specimens and studying trees, was not fortunate enough to be the very first botanist to find an unknown oak; hence, he is all the more at liberty to write of the fortunate immortals whose names are commemorated by a dozen of our magnificent or otherwise interesting western oaks.

CONSPECTUS.

Genus Quercus (THE OAKS).

Monœcious trees or shrubs of northern temperate and warm regions, of about 300 known species, especially abundant in eastern Asia and in Mexico. Wood mostly hard and durable. Leaves alternate, simple, pinnate-veined, usually broad and flat. Fruit a scaly, thickened cup sustaining a solitary, one-celled nut—the acorn. Staminate flowers in slender aments, pendulous (erect in one species) bracts caducous. Pistillate flowers solitary or scattered, consisting of an ovary with 5 to 8 styles or sessile stigmas; ovules six, but only one is fertilized, becoming the thick, fleshy, two-lobed seed filling the nut, the rudiments of the five abortive ovules remaining near the base, or along the side, or prolonged to the apex of the seed.

WHITE OAKS.

- A. Bark pale or light-colored, wood nearly white; stamens 6-9, stigmas sessile or nearly so; acorns mostly soft-shelled, seeds edible; abortive ovules basal or rarely lateral; 16 species.
 - I. Maturation annual; nut glabrous within (except Q. Emoryi); abortive ovules
 - (a) Leaves falling in autumn (except Q. Sadleriana).
 - * Leaves yellow-green and large.
 - (1) Lyrate or sinuate-pinnatified. Acorns large.

Leaves oblong or obovate, deeply lobed, usually stellate-pubescent above, pale and pubescent below; nut conical elongated, 11 to 2 inches long. Great Valley Oak

1. Q. lobata.

Leaves obovate or oblong, coarsely pinnatified; green and lustrous above, branchlets thick; buds large and very hairy; nut oval or oblong, 1 to 11 inches long. Pacific Post Oak.

2. Q. Garryana.

Leaves obovate, 2 to 5 inches long, acutely lobed, pubescent
below; nut oblong, large, 1 to 11 inches long, cup shallow. A small shrub. Brewer Oak. 4. Q. Breweri.
(2) Coarsely sinuate-toothed.
Leaves oval to obovate, thick, coriaceous, pale below; persisting
during the winter. A low shrub. Sadler Oak
5. Q. Sadleriana.
** Leaves blue-green and small.
Oblong, sinuate-dentate, entire or lobed, or spinescent-toothed,
1½ to 2 inches long, glaucous above, pubescent below; nut
small, ovate, ½ to 1 inch long. Rocky Mt. Oak
6. Q. undulata.
Oblong, entire or sinuate-lobed, conspicuously light-blue above,
pubescent below; nut large, oblong or ventricose, \(\frac{3}{4}\) to 1\(\frac{1}{2}\) inches long. Blue Oak, Douglas Oak. 7. Q. Douglasii.
(b) Leaves mostly persistent until the following spring. (Evergreen Oaks.)
* Leaves blue-green.
Oblong or obovate, usually obtuse and rounded at apex, entire
or remotely dentate; nut ovate, ‡ to 1 inch long, Ever-
green or Englemann Oak 8. Q. Engelmanni.
Ovate or oval, usually cordate at base, entirely or remotely
spinulose-dentate; nut small, ovate. Oblong-leaf Oak 9. Q. oblongifolia.
Oblong to broadly-obovate, cordate or rounded at base; spinose
dentate, reticulate-venulose below; branchlets thick,
rigid; nut small, nearly globular, 1 inch long. Arizona
White Oak 10. Q. Arizonica, n. sp.
Broadly obovate, cordate, usually rounded and obtuse at apex
repandly spinose-dentate, coarsely and conspicuously
reticulate-venulose below; nuts spicate, on long, slender
peduncles, small, 1 inch long. Net-leaf Oak
11. Q. reticulata.
Ovate-oblong or oval, small, ½ to 1 inch long, acute at apex,
entire or remotely spinose-dentate; branchlets rigid; nut
small. New and rare. Tourney Oak
12. Q. Toumeyi, n. sp.
** Leaves dark green.
Oblong or obovate, small, entire or sinuate-toothed or lobed,
pubescent and often pale below; nut small, ovate or
oblong, ½ to 1 inch long. Scrub Oak. 13. Q. dumosa.
Oblong-lanceolate, entire or repand-serrate, coriaceous; nut
small, narrow, and long, ‡ to 1 inch, edible. Emory Oak, "Blufes."
 Maturation biennial; nut silky-tomentose within; abortive ovules basal or lateral.
(c) Leaves persistent. (Live Oaks.)
Oblong acute or cuspidate, entire, or dentate, or sinuate-toothed,
fulvous-tomentose, ultimately pale on lower surface; nut
oblong, 1 to 2 inches long, scales of cup usually clothed
with short, stiff yellow hairs. Canyon Live Oak, Maul
Oak 15. Q. chrysolepis.

BLACK OAKS.

- B. Bark dark, often nearly black, wood reddish; stamens 4 to 6, stigmas on long styles; nut mostly hard-shelled with bitter astringent seeds, inner surface of nut silky-tomentose; abortive ovules toward apex of the seed; 4 species.
 - I. Maturation annual.

Leaves usually persistent until the appearance of the new crop.

Oval, orbicular or oblong, entire or sinuately spinose-dentate; nut ovate or elongated to an acute point, 1 to 1½ inches long. Field Oak.

17. Q. agrifolia.

- II. Maturation biennial.
 - (a) Leaves persistent. (Live Oaks.)

Lance-olate-oblong or elliptical, entire or spinosely-dentate toward the apex, coated with pale or fulvous tomentum on lower surface; veins very prominent; nut deeply inserted in the small hemispherical cup, ovate to oblong, ½ to 1 inch long. White-leaf Oak . . 18. Q. hypoleuca.

(b) Leaves deciduous.

Oblong or obovate, deeply lobed, lobes tapering, acute or broad and obovate, repand-dentate or entire, glabrous or pubescent when young; nut large, oblong, often mostly concealed in the broad scaly cup. Black Oak. Kellogg Oak. 20. Q. Californica.

Pasania (CHESTNUT OAKS).

DISTRIBUTION OF WESTERN OAKS.

IN CALIFORNIA 13 SPECIES.

Q. Lobata, Garryana, Breweri, Sadleriana, Douglasii, Engelmanni, dumosa, chrysolepis, tomentella, Wislizeni, agrifolia, Californica, and densifiora.

CALIFORNIA AND NORTHWARD, 4 SPECIES.

Q. Garryana, Sadleriana, Californica, and densiflora.

ONLY IN CALIFORNIA, 4 SPECIES.

Q. Isobata, Breweri, Douglasii, and Engelmanni.

CALIFORNIA AND SOUTHWARD, 5 SPECIES.

Q. Dumosa, chrysolepis, and var. Palmeri, tomentella, agrifolia, and Wislizeni.

MEXICAN OAKS, REACHING ARIZONA AND NEW MEXICO, 7 SPECIES.

Q. Gambelii, undulata, oblongifolia, reticulata, Emorni, tomentella, and hypoleuca.

ONLY IN ARIZONA, 2 SPECIES.

Q. Arizonica and Tonmeyi.

OAKS OF CALIFORNIA.

ALSO OREGON AND WASHINGTON.

1. Quercus lobata. Née, 1801. VALLEY OAK.

Monarch of the Pacific tribe, the largest and most conspicuous of the West-American oaks, is 60 to 80, often over 100 feet high, with a trunk 5 to 8, often 15 to 20 feet in diameter. Dividing often near the base, the large branches radiate to form a broad head, often 100 to 200 feet across. Peculiar for its large, oblong, deeply-lobed, shining leaves, its long, slender, often drooping, sterile branchlets, resembling a weeping willow, and for its very long, narrow acorns, 11 to 2 inches long. Hooker's Oak, on General Bidwell's farm near Chico, Cal. (named in honor of Sir Joseph Hooker, who visited the tree, with Dr. Asa Gray, in 1877), was then 150 feet in spread of branches, and the trunk was 61 feet in diameter. In Napa and Capay Valleys are some oaks over 20 feet in 12 diameter, and with a spread of branches that might shelter a regiment of soldiers.*

Found in the valleys of western California, between the Sierras and the ocean from Redding to Tejon Pass. Seldom forms a grove by itself, but often with the coast Live Oak and the foot-hills Blue Oak, it forms large, orchard-like parks. Small, slender trees, with never a drooping limb, line the banks, in places, of the low coast and valley rivers. oak is the "Roble" of the Spanish Californians and Mexicans.

2. Quercus Garryana. Hook., 1839. Pacific Post Oak.

Noble trees of the northwest, 60 to 70 feet high, with erect branches, forming a compact head. Noted for its unusually large dark green leaves and stately trunks not concealed by drooping branchlets, as in

^{*}The first voyager that has given us his impressions of this noble tree is Vancouver, who entered the Bay of San Francisco 1792, and, casting anchor, prepared to visit the Mission at Santa Clara. "We had not proceeded far," he writes, "when we entered a country I little expected to find. For about twenty miles it could only be compared to a park which had been originally closely planted with the true old English oak. The underwood-if ever there were any-had been cleared away, eaving the stately lords of the forest in complete possession of the soil, which was covered with luxuriant herbage and beautifully diversified with pleasing eminences and valleys, which, with the range of lofty, rugged mountains that bounded the prospect, required only to be adorned with the neat habitations of an industrious people to produce a scene not inferior to the most studied effects of taste in the disposal of park grounds."

A year earlier the Spanish expedition, under Malaspina, had visited the coast, and his accompanying naturalist, Prof. Louis Née, collected specimens of this and other trees, publishing, at Madrid, 1801, a description of this and of the Field Oak, giving each their appropriate names.

the Valley Oak. Readily distinguished by the large and very hairy branchlets and buds. Has a long but narrow habitat, or range, near the northern coast of California, the largest trees but a few miles from the ocean, thence extending northward across western Oregon and Washington to the borders of British Columbia.*

The form called Q. Gilberti, Greene, founded upon dense thickets of oak on the islands and shores of Puget Sound, Sargent regards as a depauperate form of this species with nearly globular, crumpled leaves, the flowers and fruit unknown. Also, Q. Jacobi, A. Brown, with ovate acorns and slightly different leaves, is thought to be but another aberrant form.

3. Quercus Douglassii. Hooker and Arnott. 1841. Douglas Oak, Blue Oak.

This local California oak is readily recognized by its small light green or bluish leaves, and its very light gray colored bark on trees growing on exposed hillsides, or darker in sheltered places, and by its location, throughout middle California, becoming trees 20 to 30 feet high on the foot-hills and slopes of the Coast Ranges and the western slope of the Sierra Nevada.**

The large acorns of the Douglas oak are collected by the "Carpintero," or carpenter woodpecker (*Melanerpes formicivorus*), which excavates holes in the bark or exposed wood of trees in which to insert these acorns, leaving them there until the larva of a beetle which infests them has grown large enough to furnish his store-room with a season's bounteous supply of fresh canned meats. The acorns of other white oaks, notably those of the Valley Oak, are treated similarly by this provident bird.

This very showy, gray-leaved oak was first collected near Monterey

^{*}The type of the species was discovered by Dr. Archibald Menzies, surgeon of Vancouver's Expedition to Puget Sound, but not published until after its discovery by Douglas, who named it in honor of Nicholas Garry, secretary of the Hudson Bay Company; but Dr. William Hooker published the description 1840, hence he is to be credited as the author of the name, according to the modern rules.

^{**}In connection with his description of the Douglas Oak in Sylva of North America, Professor Sargent offers this graceful tribute to the intelligent services of one of California's most industrious and scientific workers. "Miss Eastwood, the curator of the Botanical Department of the California Academy of Sciences, has been of great assistance to me with her unrivaled collection of California oaks, made mostly in the southern part of the state." The writer has learned that the number of papers of mounted oak specimens in the Academy Herbarium exceeds four hundred—mostly the collection of Miss Alice Eastwood, whom Prof. P. A. Rydberg purposes to justly honor by naming a pretty oak of her recent discovery in southern Utah, Quercus Eastwoodæ, sp. nov.

by David Douglas,* the indefatigable and successful Scotch botanist and explorer, in 1832. The species was named in his honor by Hooker and Arnott, in 1841.

4. Quercus Chrysolepis. Lieb. 1849. Golden Leaf Oak, Maul Oak.

This canon-loving, dark-foliaged oak of the western slopes of the Sierra Nevada, where it often becomes a tree 20 to 40 feet high, diminishing to a low-spreading bush on the higher elevations, is generally at once recognized by its long, narrow leaves, colored yellow beneath when young, with fulvous tomentum or yellow plant hairs. The usually large acorn cups are also densely clothed with short, brittle, golden hairs that leave yellow stripes upon the clothing of intruding visitors. The timber of this tree is strong and durable, and is used for various manufacturing purposes.

The typical form of this species was first collected by Karl Theodor Hartweg, "on the hills back of Monterey," in 1846. Mr. Hartweg was one of the earliest explorers to visit California, with Mr. Lobb, 1846 to 1850, collecting mostly in the vicinity of Monterey Bay, finding many plants the seeds of which were sent abroad for propagation.

Variety, vaccinifolia (Kellogg), Engelm., 1877. ALPINE OAK.

This Alpine oak is the low, bushy form found nearly up to timber line on the Sierra peaks, with small, pale, nearly smooth leaves and acorn cups, and was considered a distinct species by Dr. Kellogg, but intermediate forms grade down to the typical tree in its best estate.

Variety, Palmeri (Engelm.), Sargent, 1879. PALMER OAK.

Near the Mexican boundary line in San Diego, Cal., Dr. Edward Palmer ** discovered, 1875, dense thickets of a scrubby oak with rigid branchlets, leaves oblong or mostly orbicular, coriaceous, and spinosedentate, acorns ovate acuminate, $1\frac{1}{2}$ inches long. Regarded by Engelmann and Greene as a good species, but referred as a variety by Sargent.

^{*}No description of western trees, especially of the cone-bearing family, can be written without more or less allusion to Mr. Douglas. A brief account of him (in connection with his discovery of the Sugar Pine) is given in the report of the writer as the botanist for the 2d Biennial Rep. of the Cal. State Board of Forestry, pages 81-82, 1887-1888. He discovered seven of our cone-bearers, one of the noblest of which, the Douglas Spruce (though sparsely collected before), was given his name, 1855, and it is still retained for the popular name of the tree.

^{**}Edward Palmer was born at Wilton, Eng., 1833. His father was a florist, giving the son an early knowledge of flower culture. He came to America in 1849, settling at Cleveland, Ohio, occupied as a private nurse for a gentleman whose friend, having fine gardens, afforded young Palmer many privileges of examination and study. In 1853 he was appointed collector of an expedition sent to Paraguay. Two years

5. Quercus Engelmanni. Greene, 1889. ENGELMANN OAK.

This evergreen oak is but little known, owing to its limited home—a narrow belt about 50 miles wide in southwestern California, from Sierra Madre to within 15 or 20 miles from the coast. It is a handsome tree, becoming 40 to 60 feet high, with a diameter of 2 to 3 feet. The branches are stout and spreading, bark light gray and deeply fissured, the leaves blue-green and oblong, 2 to 3 inches long. Trees of this species were seen by Dr. C. C. Parry as early as 1850. Others collecting specimens of it since have referred the species to a similar tree in Arizona, Q. oblongifolia, but our tree has darker bark, thicker leaves, larger acorns, and the seeds are conspicuously yellow. A fine California oak, recently described (1889) and figured in West-American oaks, by Prof. Greene, and dedicated to that most profound student of American oaks—Dr. Engelmann.*

later returned to Cleveland and obtained some instruction in medicine. In 1864 he came to California, connecting himself with the Geological Survey of California, and was stationed at San Diego. Wishing to take some part in the Civil War, he went back east and was appointed hospital steward in a Colorado regiment, and served with it for a year, when he was appointed contract surgeon and stationed in Kansas, where he began the real work of his life as a collector of objects in natural history. Leaving the army, he engaged in extensive exploration. Employed by the Smithsonian Institute and the Agricultural Department for many years, he collected several important and valuable plants from the shores of the Gulf of Mexico and many interior Mexican states, as well as in the southern portion of the United States. Dr. Palmer's arduous labors and privations have been recognized by the dedication of a genus Palmerella, growing near Santa Barbara, and by species of plants in many other genera, including this of the Oaks.

*Dr. George Engelmann, born 1809, at Frankfort-on-the-Main, early became a teacher, entered Heidelberg, took a degree in medicine at Wurzburg, studied natural history with Agassiz and Braun, came to America, and soon established himself in St. Louis, where he became a very successful physician, from which absorbing profession he snatched a few hours from time to time for the study of botany, choosing the most difficult groups of plants, such as Cactacea, Cuscutz, Yucca, Agave, and the Conifers generally. Nearly all his life a closet botanist, but visiting Europe several times to consult specialists and examine herbaria, it was only toward the end of his career that he was able to see with his own eyes living individuals of the many western plants he had first made known to science. He visited California 1878, with Professor Surgent and Dr. Parry, to study our trees; their size and number filling him with amazement. Dr. Engelmann was a many-sided man; he kept a careful record of meteorological data for forty-eight years-practically a half century-in the hope that he could discover some periods of hot or cold, of wet or dry seasons, but was compelled to state that he "had learned nothing of the laws of nature in regard to weather." After a long life of almost matchless activity and research, the end came

Dr. Engelmann's writings, collected and published by his son, make a thick volume on subjects that left but little to learn by others. His name will be preserved by the genus *Engelmannia*, a large, handsome yellow flower of the western

6. Quercus agrifolia. Née, 1801. FIELD OAK, "ENCENA."

This well-known, dark-barked, prickly-leaved, low-browed oak is common in the coast region of central California, especially about the Bay of San Francisco, where it attains its largest size, 20 to 40 feet in height, if sheltered from the ocean gales; but in exposed localities the saplings are early assaulted by the winds, and as the tree divides near the base into diverging branches, they are overborne, those on the lea side often resting their elbows on the ground, while the branchlets are prolonged year after year, in the direction of least resistance away from the sea. Trees are known to creep in this manner fifty feet or more. Owing to its nearness to Monterey Bay, one of the first harbors on the coast to be visited by European explorers, this was the first oak discovered, 1791, by Prof. Louis Née, a French botanist with the Spanish expedition of Malaspina. Aside from the publication at Madrid, 1801, of this oak with the Valley Oak and other plants collected on this expedition, little is known of this, the first naturalist to make known to the reading world in technical language the vegetable wealth of the Pacific slope.

Prof. Sargent, in his Sylva, writes of this oak: "The valleys and low hills of the California coast owe their greatest charm to this oak tree, which, dotting their covering of vernal green or their brown summer surface with its low, broad heads of pale, contorted branches, and dense, dark foliage, gives them the appearance of incomparably beautiful parks." The classic oaks of Berkeley belong to this species.

7. Quercus Wislizeni. A. de Candolle, 1864. LIVE OAK.

A fine black oak, often 50 to 80 feet high, trunk short but frequently thick, 4 to 6 feet in diameter, branches spreading, forming a rounded top; bark thick, 2 to 3 inches. Headquarters in middle California, extending from the lower slopes of Mt. Shasta southward through the Coast Ranges to Santa Lucia Mountains, shrubby forms continuing on the southern mountains to the peninsula of California, also on a few of the Channel Islands. On the western slope of the Sierra Nevada it mingles with the Douglas Oak, in sharp contrast of color; and, lower down, with the Valley Oak, from which its small, oblong, entire, dark green leaves readily distinguish it. At flowering-time, as Prof. Jepson writes, "The aments from a terminal bud or a cluster of buds are often so numerous and large as to transform the appearance of the tree, in April or May, imparting to the crown a singularly soft and billowy yellow-green appearance." First discovered by Fremont in the Sierra

plains; by the handsomest of the apruce trees of the Rocky Mountains; by a conspicuous cactus of the deserts of the southwest, and by hosts of smaller plants; and also it will be held in honored remembrance so long as the trees of the New World remain a subject of interest to students.

Nevada, but described from specimens collected by Dr. F. A. Wislizenius, on the American River. This beautiful oak commemorates the labors of another early and successful explorer of western America, especially the southern portion of New Mexico and Arizona, and in Mexico, where the doctor collected many plants new to science, including a curious genus of the Capar family, named Wislizenia, in his honor.

8. Quercus Californica. Cooper, 1859. Kellogg Oak, Black Oak.

This most interesting of the California black oaks is at once distinguished by its very dark, smooth bark (while young), and its large, deeply-lobed leaves, each lobe tipped with a 1-inch bristle. With head-quarters in northern California and southern Oregon, where it often attains a height of 80 to 100 feet and a diameter of 2 to 4 feet, this tree ranges from the basin of McKenzie's River, in northern Oregon, southward through the Coast Ranges and along the western slope of the Sierra Nevada, which it ascends 7,000 to 8,000 feet; to the San Bernardino Mountains and others of San Diego County, its limit being on the Cuyamaca Mountains. Low, scrubby bushes with small leaves and acorns, not reported hitherto by botanists, were among the first of the discoveries of the writer in Sierra Valley, on the east slope of the Sierra Nevada, and may be designated as var. transmontana.

This noble tree was first collected by Hartweg, 1846, near Sonora. Dr. John Torrey referred it, 1856, to Quercus tinctoria, as var. Californica. Dr. J. S. Newberry, deciding it to be a distinct species, named it, 1857, Quercus Kelloggii, in honor of California's pioneer botanist, Dr. Albert Kellogg.* Under the rules of nomenclature demanding that the first applicable name given it must be accepted, Californica must be the specific name of this oak—and, incidentally, it was published as Quercus Californica by Dr. Cooper, 1859. However, California botanists, hailing with delight the name of Kelloggii, have held to its use until a late date; while the general public has indelibly fixed the popular English name of this interesting tree as the "Kellogg oak."

^{*&}quot;Good Dr. Kellogg," as he was called, well deserved this honor, being a true-hearted, industrious, and successful botanist. Coming to California in 1849, he had matchless opportunities in botanical research. With seven others he he'ped to found the California Academy of Sciences and early became curator of the herbarium, a position held until the time of his death, which occurred 1887, at the age of seventy-four years. He made several botanical excursions up and down the coast, including one to Alaska. Discovering many plants new to science, he had the privilege of naming a marked variety of the Kellogg Oak (Q. Californica, var. Morchus), three species of ceanothus, three of lily (including the magnificent Lady Washington of the High Sierra), and scores of smaller plants. A Gaium-like genus, Kelloggia, found on the mid-Sierra slopes, was dedicated to him by Dr. Torrey, and this with his many botanical papers will preserve the memory of this gentle-spirited lover of nature as long as California plants are collected and studied.

9. Quercus densiflora. Hooker and Arnott. 1841. TAN BARK OAK. CHESTNUT OAK.

This beautiful and curious species—resembling a chestnut as much as it does an oak—becomes in its headquarters along the streams in Marin County, a tree 40 to 60 feet high, with a trunk 2 to 5 feet in diameter. It ranges from Umpqua River, in southern Oregon, where it is reduced to a small tree but a few feet high (var. echinacea), southward along the Coast Ranges to the Santa Inez Mountains, of southern California; also, it is found on the west slope of the Sierra Nevada to an elevation of 4,000 feet. Peculiar for its large, long (3 to 4 inches), and erect male flowers, its chestnut-like leaves, and the characters of the acorn cup, the scales of the typical oak being replaced by fleshy awl-shaped spurs, $\frac{1}{4}$ to $\frac{1}{2}$ inch long, divergent or recurved. The nut, also, is peculiar, being somewhat triangular, looking from above, and it is covered with a dense coat of very short brown hairs.

Whenever this species attains the dimensions of a tree, small or large, as Dr. Kellogg remarks, "It is the most regular and symmetrical of oaks;" and Prof. Sargent states: "No oak of western America excels the best representatives of this species in massive beauty of outline or in richness of color. In early spring the elongated tender shoots and unfolding leaves, coated with white hairs, appearing like masses of flowers against the dark background of older leaves, light up the coniferous forests with a beauty all its own."

The large proportion of tannin which the bark contains renders it one of the most useful of our trees, and the many cargoes of this bark which are annually loaded at San Francisco from the northern coast regions would make botanists apprehensive of the early extinction of this beautiful tree, were it not for the knowledge that the stumps left by the bark hunter sprout readily from the base—so continuing the life of the species in the same manner as that by which the Coast Redwood is preserved.

The tan-bark oak is the only representative in America of a peculiar group of trees found in central and eastern Asia, in which are combined the characters of the oak and chestnut; and from this circumstance it suggests, first, a common origin long ago, in the Arctic region perhaps, from whence the two forms have widely diverged; and, second, a lower formative state of the line of development before it became a fully-equipped oak. This species is one of the most interesting inhabitants of the forests of the United States.

The group of chestnut-like oaks to which this species belongs was erected into a sub-genus by Prof. Oersted, and named Pasania.*

^{*}The separation of this group of trees from the genus Quercus by Oersted, is but in accordance with the progress of botanical science which divides and subdivides, if

10. Quercus Breweriana. Engelm, 1880. Brewer Oak.

A low-spreading bush or becoming a small tree, forming thickets on the western slopes of the Sierra Nevada, from near the northern border of the state of California south to Tulare County. On the upper San Joaquin, at an elevation of 5,000 to 6,000 feet, forming vast, almost impenetrable thickets, the slender stems, 12 to 18 feet high, standing for miles as evenly as a field of wheat. Discovered 1862, on a ridge near Mt. Shasta, by Prof. Brewer.* Collected in the vicinity, 1867, by the writer, whose full specimens sent to Dr. Engelmann decided him to regard it as an undescribed species. Prof. Greene refers this to another species, Q. Oerstediana, R. Brown, but Prof. Sargent regards this reference as decidedly incorrect.

11. Quercus Sadleriana. Brown, 1871. SADLER OAK.

A shrub 3 to 6 feet high, forming extensive thickets on the high slopes of a limited region in northwestern California and southwestern Oregon, mostly on the Siskiyou Mountains. Discovered, 1852, by John Jeffrey, the Scotch gardener, who collected a sterile branch only, while the full characters remained to be discovered by R. Brown, 1862, on the Crescent City trail near the Oregon line. Leaves resembling those of the chestnut, but thinner.

necessary, the early-named groups as required for exact classification. The small group of trees in question have almost perfect chestnut-like leaves, large, long, and erect staminate flowers, fruit cases or cups clothed with long, half-inch, subulate appendages in place of scales. The nuts are broad and short and often slightly triangular at the apex—these marked characters clearly determining that, as Prof. Greene says, "This peculiar species of tree is as near to the chestnut as to the oak." But as this tree is neither one nor the other, and quite distinct, very properly it may be regarded as entitled to generic rank, when our species would have to be named Pasania densiflora, nom. nov. California Chestnut Oak.

*Prof. Wm. Henry Brewer was born in Poughkeepsie, New York, 1828. At an early age he showed a fondness for natural scenery and botanical objects, obtained a college education, and early took a chair in the Sheffield Science School, at Yale University, a position he still occupies. In 1860 he was appointed first assistant of the U.S. Geological Survey of California, and came out with a party, of which Prof. J. D. Whitney was chief. California was quite thoroughly explored from 1860 to 1864. Professor Brewer was the first to botanize the High Sierra to any extent, gathering plants and taking notes. He subsequently studied the plants for the Botany of California, issued 1876, by Brewer, Watson, and Gray. Professor Sargent writes of him: "Professor Brewer rendered very important services in elucidating the Flora of California, exploring the high peaks of the Sierra Nevada, the remotest fastnesses of which he explored, crossing and recrossing the passes, rewarded by having one of the highest peaks named Mt. Brewer," and, as a farther title to immortality, the writer would add his name was given to a lovely Weeping Spruce, Picea Breweriana, Watson, of which Mr. Thomas Howell, of Sauvis Island, Oregon, gathered full specimens 1885, on the Siskiyou Mountains, but meager specimens (without fruit) had been collected 1863, on the top of Black Butte or Muir's Peak near Mt. Shasta, by Professor Brewer, so the bonor of its first discovery came to him.

The writer collected specimens of this species near the locality of the Weeping Spruce, 1887, but a sudden storm of rain prevented their preservation. Prof. Brown named this oak in honor of John Sadler, born 1837, in Scotland, an associate of Prof. Balfour, and in 1862 secretary of the Arboricultural Society of Scotland. He traveled extensively, and made many discoveries of new stations of plants in Great Britain.

12. Quercus dumosa. Nutt, 1842. Scrub OAK.

An intricately-branched shrub with stout stems, forming dense thickets, or in cañons, becoming tree-like, very variable, and several forms have received other names. Western slopes of Sierra Nevada, common south of San Francisco to San Bernardino Mountains, and on the Channel Islands, where it attains its largest size. Var. revoluta, Sargent, is the form common north of San Francisco.

This shrub oak, with Brewer's and Sadler's, comprise the small species of oak in California, and complete the number of 13 species of oak found in California and northward.

SOUTHERNOAKS.

(Space)

MOSTLY IN ARIZONA AND NEW MEXICO.

1. Quercus Emoryi. Torrey, 1848. Emory OAK.

The most abundant oak in Arizona and vicinity, forming a large part of the open forests on the mountain-sides. On low ground becoming a tree 30 to 80 feet high, diminishing to low, scraggy bushes at upper limits. Distinguished by its dark brown bark (which caused it to be at first classed with the black oaks), its rigid branchlets, dark green, oblong, acute, leathery leaves, and its small, narrow, sweet acorns, called by the Mexicans "Bellotas," and gathered in great quantities for food. Discovered, 1846, by Col. W. H. Emory, commanding a government exploring expedition across the continent from Santa Fe to San Diego, collecting 160 species of plants, including this, one of the most beautiful and useful oaks of the region.

2. Quercus oblongifolia. Torrey, 1853. Evergreen Oak.

Another oak of nearly the same range, especially south of the great plateau of Colorado. Recognized by its pale checkered bark, round compact head, and light blue foliage. In favorable situations becoming trees 20 to 30 feet high. At lower stations it mingles with the dark Emory oak in pleasing contrast. Discovered 1851, by Dr. S. W. Woodhouse, botanist of Capt. Sitgreaves' expedition to the Zuni and Colorado Rivers. Dr. Woodhouse collected animals as well as plants, making a valuable collection preserved in Smithsonian Institute.

3. Quercus undulata. Torrey, 1828. Rocky Mountain Oak.

This, the easternmost of our western oaks, is found abundantly on the eastern foothills of the Rocky Mountains, forming thickets of vigorous stolons or traveling sprouts 2 to 3 feet high, extending to Utah and southern Nevada, southward to New Mexico and Arizona, where it becomes trees 20 to 30 feet high. Known by its small, wavy, often spinescent leaves. Quite variable, some of its forms receiving distinct names; as, Q. pungens, Q. Fendleri, Q. grisea, and Q. turbinella. Discovered by Dr. Edwin James, botanist of Major Long's expedition to explore Rocky Mountains. The doctor's rich collection included also the Rocky Mountain white pine, Pinus flexilis.

4. Quercus Gambelii. Nuttall, 1848. GAMBEL OAK.

Another of the small oaks of the Rocky Mountains, extending westward to the Wasatch Mountains, of Utah, thence southward in larger forms to New Mexico and Arizona, on the summits of mountains. Distinguished by its large dark green and deeply-lobed leaves, and its dark gray, deeply-fissured bark. Discovered 1844, on the banks of the Rio Grande, by Wm. Gambel, an early student with Nuttall, and botanist of a party that explored largely in the southwest. He joined Capt. Boone's party of gold seekers, 1849, and shared with them in the fatal disaster of imprisonment by an early snowfall in a pass of the Sierra.

Sargent regards Greene's Q. venustula as belonging here, a beautiful shrub with less-lobed leaves and very small acorns, on mountains of southern Colorado and northern New Mexico.

5. Quercus reticulata. H. & B., 1807. Net-leaf Oak.

One of the large trees of Mexico, 20 to 30 feet high, that extends in smaller forms into Arizona and New Mexico, as a very showy shrub on high elevations. At once detected by its oblong or nearly round, thick, leathery leaves, which are strongly net-veined beneath, and its generally, many-fruited spikes of fruit, 1 to 5 inches long. American specimens first discovered 1874, on Mt. Graham, 9,500 feet altitude, in northern Arizona, by Dr. J. T. Rothrock, and soon after by other explorers, including the writer, on same mountain and on Santa Catalina, Santa Rita, Chirricahua, and Huachuca Mountains. This pretty oak would be a prize if it could be cultivated, and experiments should be made to determine.

6. Quercus hypoleuca. Engelm, 1876. WHITE-LEAF OAK.

Another beautiful black oak of Mexico, inhabiting, also, the mountains of Arizona and New Mexico south of the Colorado plateau. where it becomes a tree 20 to 40 feet high. Distinguished by its lanceolate, thick leaves, which are densely clothed beneath with short, white hairs, the veins prominent, often reddish. Discovered 1851, by Charles Wright, one of the most successful botanists of the Mexican Boundary Survey.

The foliage of this and the preceding species is as striking and beautiful as that of any oak in cultivation.

7. Quercus tomentella. Engelm, 1877. Corton-leaf Oak.

A little-known oak on the Channel Islands of Santa Barbara and the far-distant Guadaloupe Island off the coast of the California peninsula. Found generally in deep, narrow canons, and threatened with extinction.

Prof. Sargent writes of this oak: "It is possible that this once grew to a large size. The only specimens I saw were on the eastern side of the Santa Catalina Island, south of Avalon, where there is a small grove of stems about 30 feet high, in a circle 11 feet in diameter, evidently shoots from a large tree." Discovered 1875, on a bleak crest of Guadaloupe Island, by Dr. Edward Palmer, the distinguished traveler and collector.

8. Quercus Arizonica. Surgent, 1895. ARIZONA WHITE OAK.

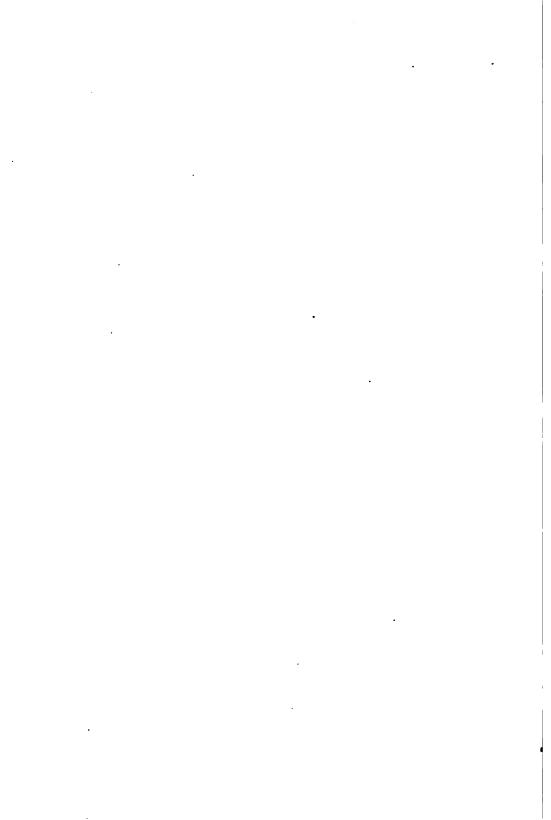
This is the most common and widely-distributed white oak of southern Arizona and New Mexico, covering, with the Emory oak, the slopes and canons of the mountains up to an elevation of 5,000 to 10,000 feet. Long been confounded with the Rocky Mountain oak, but distinctly separated by its pale bark and shapely head of bright foliage, with large leaves net-veined below. "To this tree," Sargent states, "is due much of the beauty of the forest covering Arizona mountains where the Emory oak is the only broad-leaved tree that exceeds it in abundance."

9. Quercus Toumeyi. Sargent, 1895. Toumey Oak.

This little oak is the most limited and local of any species in the regions of the Pacific slope. Inhabiting one side of a single mountain—Mule Mountain, in Cochise County, southeastern Arizona—it forms stunted open forests between a belt of the Emory Oak and the summit. The small, ovate, thick leaves, the small fruit, and limited station serve to distinguish the species. Discovered 1894, by Prof. Toumey,* and published with a plate by Prof. Sargent the following year.

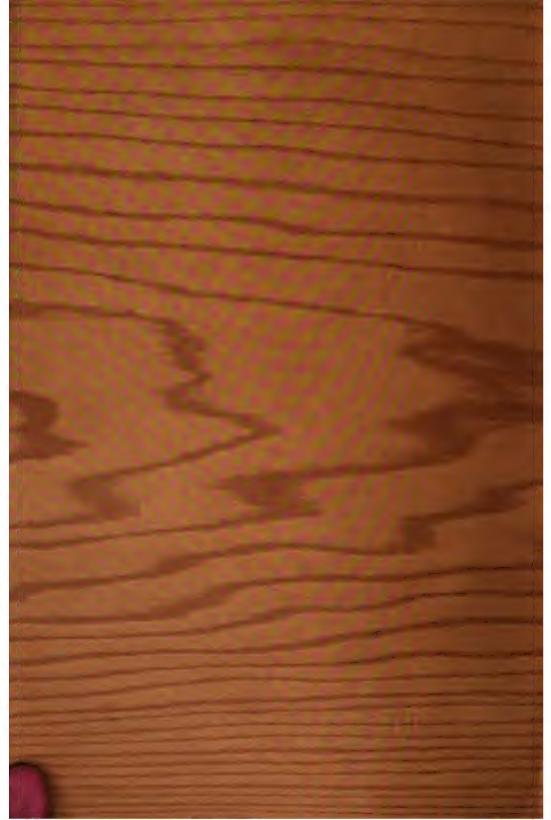
^{*}James Wm. Toumey was born in Van Buren Co., Michigan, graduated from Michigan Agricultural College 1889, becoming a year later Assistant Professor of Botany in that institution. Appointed Professor of Botany and Entomology in the University of Arizona at Tucson, 1881. Becoming absorbingly interested in the flora of that territory, he has explored carefully certain little-known regions, rewarded by many important discoveries, crowned by this latest and best. He is now in charge of the Forest Tree Cultivation Bureau at Washington, and has issued instructive bulletins on the subject of tree culture.

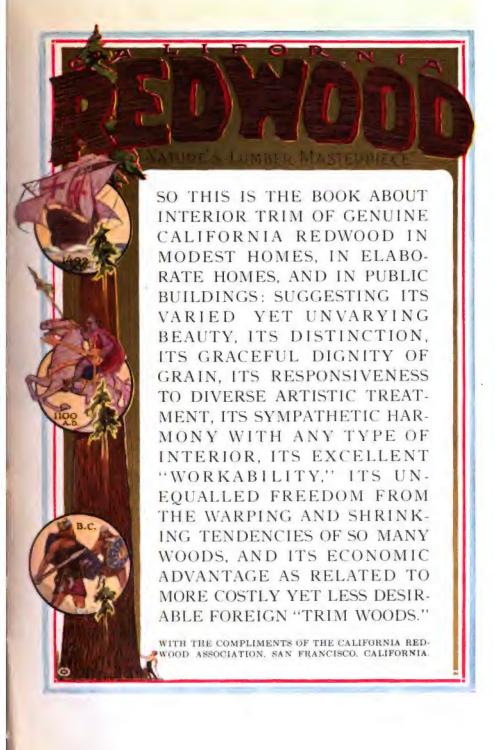
Lemmon Herbarium, Oakland, Cal., Dec., 1901.

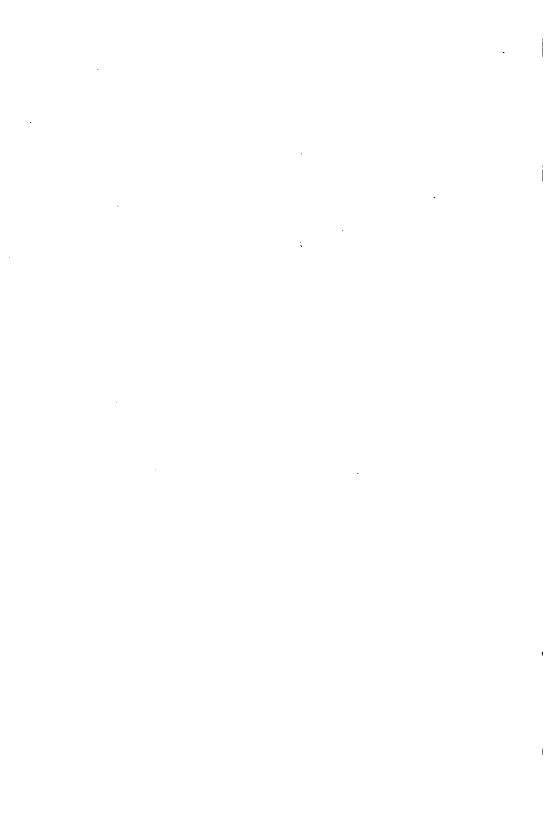


CALIFORNIA

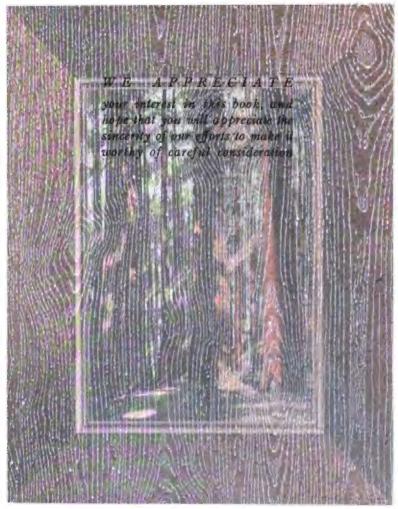
"NATURE'S LUMBER MASTERPIECE"







of Oenerable Trees"-Oordsworth.

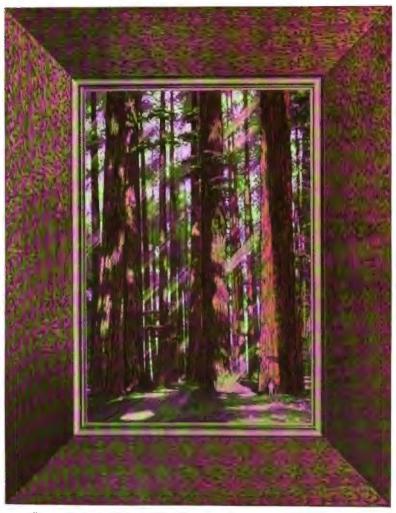


Think you tis wrong to fell such movesty? Then is it wrong to oig the coal of parts? If reverently done, for weal of man. The death of trees becomes another birth: A birth of uso, of service with a beautiful Distinct in kind, yet of a broader worth? Coppight, 1918, by Croby-Chicago, Inc., (Pullman Bullding) - 1/33.

WE APPRECIATE

your interest in this book, and hope that you will appreciate the sincerity of our efforts to make it worthy of careful consideration

"A Brotherhood", of Oenerable Trees-- Wordsworth.



"Think you tis wrong to fell such majesty?
Then is it wrong to dig the coal of earth?
If reverently done, for weal of man,
The death of trees becomes another birth;
A birth of use, of service with a beauty
Distinct in kind, yet of a broader worth."

—73.c.

EASY REFERENCE TO WHAT FOLLOWS:

This page is an informal digest of the interesting and valuable REDWOOD facts contained in this book—which we present for the enjoyment of all lovers of beautiful interiors and for the economic benefit of those who care enough about cost to intelligently insist upon superior material values as well-as art values.

ABOUT REDWOOD, "NATURE'S LUMBER MASTERPIECE:"

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COUNTRY-WIDE EXAMPLES OF REDWOOD INTERIOR TRIM:

Photographs illustrating its great variety of use and growing popularity. New Jersey, pages 4 and 5; San Francisco, 7; Michigan, 10 and 11; California, 8, 9, 12, 13, 14, 15 and 16; Minnesota, 17; New York, 18 and 19; California, 20 and 21; Connecticut, 22; California, 23 and 24; Wisconsin, 29; "Everywhere," 26; San Francisco, 30; Los Angeles, 39; Mexico, 40; California, 41, 42 and 43; New York, 45; New Hampshire, 47; WOODLAND SCENES: An Average Redwood and An Average Man, 6; Among the Redwood Giants, 28; A Sentinel of History, 68.

TEN FOUR-COLOR REPRODUCTIONS

picturing Redwood in its natural state and with a few of its most winsome and practical finishes. (15 additional recipes are given but not illustrated.)

THE REDWOOD SERVICE BUREAU:

If we succeed in doing for you, and for other readers of our advertising, even a part of what we are trying to do, we shall feel comparatively well satisfied—and hope that you will, also. Our purpose is to maintain in this department a genuinely personal and invariably dependable service, which shall fortify the favor which this wonderful wood earns for itself, and shall add to your affection for its beauties a complete reliance upon its rare qualities of "good behavior" and a sincere respect for the exceptional economies related to its use.

Write us freely of your plans—and your hopes. Let us aid you in your planning—and in your hoping. Let us show you in detail just why REDWOOD is best for YOU—when it is. In cases where some other wood is better for you, let us tell you that. In short, rely on us for facts only—facts of value, of encouragement and of bright confidence. Write us openly—we will reply in the same spirit—and we all shall be gainers by such frankness.

Please address "The Service Bureau" of the California Redwood Association, San Francisco, California



The Character of the House is Determined by its Interior Trim.

THE INSIDE OF THE HOUSE is more important than the outside; it is interesting to consider that the only purpose of the outside is to keep the weather away from the inside.

Upon selecting the site, you discover that the portion of the atmosphere which is destined to become the Interior of your home, and which you plan shall on some early day become imbued with the mellow flavor of beautiful rugs, pictures and hangings; which soon shall be warm with the tinge of hospitality, sweet with the aroma of grace and love and dignity, and likely resonant with the laughter of children—this prospective cubic content is now but an indistinguishable part of the great expanse of outdoors!

So, to rescue, as it were, the inside of your house from the infinity of space, you hurriedly yet carefully box it in with walls. You do not thereby Create an inside—for it



The Garden Front; "Darlington," Residence of Emerson McMillin, Esqr., in New Jersey. Mr. James Brite, Architect, New York. (Illustration of Interior on Facing Page.)

was the inside that existed first in your dreams; you merely define it and make visible to others what before you alone knew the form and look of. Is not all this true?

The inside, then, really is about all there is to the house, as far as living is concerned, and the interior finishing and furnishing together are the vital part of the task of home creation.

Immediately we grant these foregoing premises, we must acknowledge the superior importance of our discriminative selection of the most beautiful and adaptable wood for the "interior trim" of the house we are to be so proud of for the rest of our lives.

BEAUTIFUL, ENDURING



The Dining-room at "Darlington;" the Entire Interior Executed in California Redwood. Note the Superb Carvings and Wonderful Breadth of Panels (Indicated at Right of Picture).

Inside the house is where we live. Inside the house is home. What we have inside the house, and what we do inside the house determine the kind of home we have and the kind of sentimental and moral heritage which we bestow upon our children.

It is true that the outside of the house and the grounds surrounding it (if there are grounds surrounding it) are contributions to the memory of "home," and that, altogether, they constitute the homestead; yet, although we beautify the exterior of the house and embellish its environment primarily for our own pride and happi-





Butt of a Redwood Log, (stripped of bark) Showing the Preponderance of Heart-wood over Sap-wood. The "Heart-wood" is the Characteristic and Valuable Part of Any Tree.

ness, is it not true that in doing so we have somewhat in mind the impression upon our neighbors and upon alien passersby? Is it not true that to an extent our homestead exteriors are designed to please the multitude? Is it not equally true that the interiors of our homes are for ourselves and our close intimates in much larger ratio to our whole purpose than are our "outsides?"

If we grant this much, may not we grant the prime need to us (who either are building, or about to build, who contemplate building, or who hope some time to build our own home) of a very early and very careful study, and deliberate,



Rich in Quiet Dignity. A Corner of the Panelled Redwood Ceiling in Lodge Room No. 1, Masonic Temple, San Francisco. Messrs. Bliss and Faville, Architects, San Francisco.

positive choice, of the kind of wood to be used as the interior trim of our homes?

Our choice on this point comes before our choice of furniture, or pictures, or rugs, or other objects of art, and, if we are wise, it influences, when it does not actually determine, all of our subsequent choices in other fields of selection.

A certain famous architect once wrote in a letter to a friend "My preferences (for California Redwood) are rather hard to analyze, beyond stating that the general effect of the interior of a living or diningroom finished in Redwood produces a most satisfactory and restful effect, and the result of its use is so pleasingly homelike,





The Restful Effect of an Unrelieved Redwood Interior. Residence of Otis Johnson, Esqr., Fort Bragg, California.

that I often choose it in preference to the more expensive hardwoods."

Singularly enough, an editorial writer in the House Beautiful magazine expressed the same subtle effect impressed upon the sensibilities of home-lovers by Redwood interior trim, by asking, in the midst of a critical article mentioning many other species of wood, "What could be more deliciously wholesome, cleanly and homelike in its effect on the senses than natural Redwood lightly waxed?" Illustrative of the need of this book, it is with unusual satisfaction, that we quote

Illustrative of the need of this book, it is with unusual satisfaction that we quote the following from the December, 1912,

BEAUTIFUL, ENDURING FIRE-RESISTANT, SANITARY



Another All-Redwood View in the Hospitable Residence Illustrated on the Facing Page. Mr. F. J. Maurer, Builder.

issue of the Architectural Record, (New York) than which there probably are few better American authorities:

"With California Redwood for interior decoration, eastern architects and builders



Residence for Michael Cudahy, Esgr., Mackinac Island, Michigan. Mr. Frederick W. Perkins, Architect, Chicago.

are practically unfamiliar, so rarely is it used this side of the Mississippi. Nowhere is its beauty and utility so richly or effectively demonstrated as in the diningroom of Georgian splendor" (in "Darlington" the country estate of the late Mr. George Crocker, later the property of Mr. Emerson McMillin, among the Ramapo hills of New Jersey).

"Three varieties of REDWOOD are used: the burl, which is the root of the tree; the straight and the curled grain. (Read the foot-note.) The

(Ed. NOTE - The magazine writer was in error on this point. Burl is not the root of the tree. Please refer to pages 13-14.)

REDWOOD BEAUTIFUL ENDURING FIRE-RESISTANT, SANITAR



The Impressive Entrance Hall in the Residence Shown Opposite; the Panels and Trim are of California Redwood.

markings which lend such varied beauty are secured by a peculiar way of sawing the wood.

"The walls are a series of great panels with moulded frames, between which are pilasters carved in high relief. These pilasters support cornices, also elaborately carved, and which give way at the end to Corinthian columns. Over the fireplace of black, green and brown marbles, is an elaborately carved over-mantel. This huge and elaborate oral design is carved out of a solid block of Redwood and is the work of an Italian of twenty-six."



Redwood Room in Residence of Edward C. Ray, Esqr., Santa Barbara, California. Mr. E. Russel Ray, Architect. Redwood's Singular "Homey" Quality is Well Shown Here.

(On page four you may see an exterior view of "Darlington," and on page five a view in the dining-room, showing at the far end the fireplace above described.)

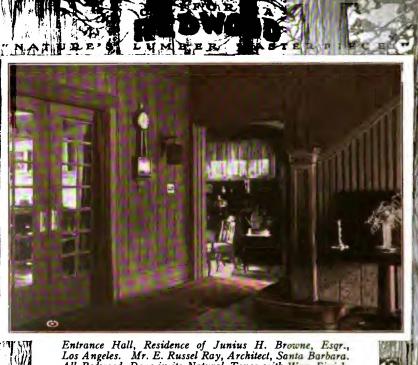
Lest we all should become imitative of the rare exception, and so destroy the excellence (and retard the advance) of the average taste, it should be said that the general trend of present-day cultivated artistic judgment is distinctly away from the "freakish" curly or bird's-eye grain, and also from the "louder" effects of "slash" grain in wood for tasteful interior trim. The favor of those whose judg-



Redwood Dining-room of Mr. Lewis P. Hobart, Architect, San Mateo, California. Notice the Panels Five Feet Wide. Finish is an Inviting, Warm, Greyish-Brown (Acid Stain).

ment counts most is going to the quieter effects attained by the "vertical" or "edge" grain method of sawing, or to a combination of the vertical grain with the milder examples of flat grain in the same piece of Redwood—as often occurs. (It is only rarely that a wide board can be found which is all strictly "edge" grain.)

The bizarre figure of "burl," "curly" and "bird's-eye" in wood grain is wearying to the senses if overdone; this is almost true even in a rich and consistent setting such as is afforded in the Jacobean palace



Los Angeles. Mr. E. Russel Ray, Architect, Santa Barbara. All Redwood, Done in its Natural Tones with Wax Finish.

of Mr. McMillin. This is fortunate, as the exceptional or accidental growths producing these effects are so rare as to be uncommercial in quantity; they cannot be made, nor foreseen, nor wished into existence; they simply have to be found, stumbled on, where they happened to occur (usually by some ancient injury to the trunk of the tree). There is a sermon in the "disorderly charm" of grain found in a defective (though sound) part of a great tree; just as we ourselves do in our moral stresses and conquests, it has evolved a superior beauty out of its effort to correct a blemish or heal a wound. The simpler effects, however, are more

BEDWOOD BEAUTIFUL ENDURING FIRE-RESISTANT SANITAD



Dining-room in the Residence Shown Opposite. Redwood Trim with Hand-Rubbed White Enamel Finish. The "Egg-Shell" Finish on Redwood is Like Marble—and Stays So.

livable, and in Redwood their variety, of both figure and tone, is so great as to be captivating to the cultivated artistic sense in a degree almost unequalled in the world of refined and beautiful woods.

SOFT WOOD FOR FINE INTERIORS

The old idea, that only an imported, or an expensive domestic, hardwood was adequate for high-class interior trim, is no longer the determinative fallacy that it used to be. Neither is it any longer the belief of anybody that a so-called "soft" wood must needs be covered up and disguised and rendered ridiculous by heavy layers of alien and unbeautiful paint, or the greater horror of artificial "graining"



Entrance Hall in the Midwick Country Club, Pasadena. Redwood Beams and Trim Throughout. Mr. J. Martyn Haencke, Architect. An Achievement in Simple Dignity,

(in imitation of species that never existed); these latter practices almost amounted to an offense against true modesty—certainly they were an affront to every healthy art sense.

The natural beauty of naturally beautiful woods (Redwood naturally being uppermost in our minds as we write) is now recognized as an asset of culture and a daily delight to its discriminative possessor. The only exception nowadays is the deservedly popular and essentially worthy Colonial effect achieved by white enamel, sparingly employed. No house should all be done in any single finish.



"Haymount," Seen from the Park; Estate of W. W. Fuller, Esgr., Briarcliff Manor, New York. Mr. Arthur T. Remick, Architect. (See Interior View on Facing Page.)

emanates confident cheer and radiant hospitality. In the Entrance Hall the woodwork best expresses us when it speaks of substance and security without heavy dullness, of family pride without pose, and of the fine traditions of Welcome without the taint of affectation.

The Redwood panels (and the exposed beams if you like them) of the Diningroom reflect the spirit of good humor, leisurely comfort, plenitude, bright responsiveness and easy digestion, artistry in practical things and open-handedness of mind, if we may put it that way. And the woodwork of the pantry and the kitchen—well, they must neatly,



Breakfast Room; "Haymount;" all in California Redwood, Exquisitely Enameled in White with "Egg-shell" Finish. No Other Wood is Quite as Perfect a Basis for Enamel.

prudently, precisely and sanitarily announce to the casual glance of the privileged guest the fundamental philosophy and practices of you and yours. Up in the sleeping chambers your "Sequoia Sempervirens" (Redwood) trim, whether finished in its natural face and cleanliness, or dressed up in chaste white enamel, (as a base for which a very close-grained, and non-resinous wood like this is vital,) conveys the "feel" of seclusion, security, peacefulness and quiet rest.

As a writer in the Craftsman Magazine says, the homestead as a whole "is a part of ourselves, an expression of our personal taste and convictions, a place



The Music Room in the Residence of G. O. Knapp, Esgr., Montecito, California. Exceptionally Beautiful Effects in Redwood with Acid Stain. Mr. E. Russel Ray, Architect.

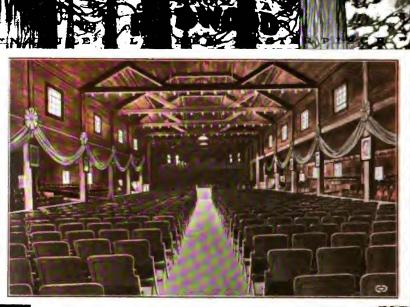
where children may grow and learn and play, where men and women may find work and rest and happiness, and where old age may come with understanding, comfort and peace. This is the ideal toward which America today is looking. "We are regaining architectural sanity, building for utility, comfort and lasting beauty, and leaving behind as useless and encumbering details all those ornamental frills that were once considered so essential to every house. Indoors and out, we are making our dwellings as simple and durable, as hygienic and restful as modern

BEAUTIFUL, ENDURING FIRE RESISTANT, SANITARY



The Library in the Residence Shown on Opposite Page. California Redwood Trim Throughout. A Notable Example of Reserved Beauty and Artistic Unity of Design and Color.

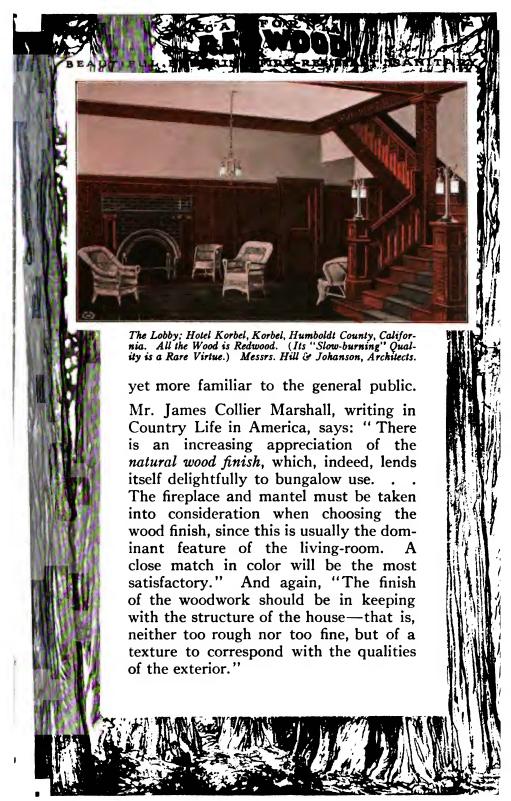
science, skill and care can make them. And in evolving and perfecting our architectural standards, our houses are becoming not only more comfortable places to live in, but also more satisfactory and substantial investments for the present and succeeding generations. The building of a successful home, however, is no small undertaking. Most people, face to face with this important task, find themselves unprepared. They have a lot of enthusiasm, but no experience. They have an ideal, but lack the knowledge necessary for carrying it out. Unless



"The Music Shed," Norfolk, Connecticut. Mr. E. K. Rossiter, Architect. "A Hospitable Warmth Pervades It." A Successful Use of Redwood in Low-Priced Construction.

they can turn to some authentic source for advice and information, they find their home-building a rather experimental affair."

It is to contribute our share toward the most intelligent mastery of these problems of selection that we print this book. We do not wish you to use Redwood in any case where some other species of lumber might better serve your purpose, but we shall be gratified (and amply repaid) if you merely insist upon Redwood in cases wherever it is best for you, and, after a study of this book, give your personal taste and judgment free play in cases where there may be a fair choice between Redwood and other woods less desirable, and probably more expensive,





Living-room; Residence of Mr. Elmer Grey, Architect, Oak Knoll, Pasadena. Artistic and Homelike Effects in Redwood Interior Trim, Including the Carved Mantel.

In the same spirit is the statement in Cram's "Impressions of Japanese Architecture" that "To the Japanese, wood, like anything that possesses beauty, is almost sacred, and he handles it with a fineness of feeling that, at best, we reveal only when we are dealing with precious marbles. From all wood that may be seen close at hand, except such as is used as a basis for the rare and precious lacquer, paint, stain, varnish, anything that may obscure the beauty of texture and grain, is rigidly kept away."

Plates I, II and III in this book are





Baptist Church in Santa Rosa, California. 1873. Sill to Spire including Panels, Pulpit and Seating, of Lumber from a Single Redwood Tree. 78,000 board-feet, and Many Shingles.

excellent examples of the wonderful possibilities of varied beauty which are quickly and economically available to the present-day user of California Redwood; Plate V illustrates the same doctrine of rare beauty achieved by simple and entirely natural means, as it requires merely a careful scorching of the surface of Redwood with the flame of a gasoline torch (such as is used by plumbers,) the brushing out of the charred wood with stiff bristles, and then washing with alcohol, followed by a light waxing if desired. There is only one other species of wood native to America, on which this





Characteristic "California Bungalow;" All Redwood, Inside and Out; a Type Which Has Become a Distinct School of American Architecture. Redwood Vields Interior Beauty and Warmth, with Exterior Endurance and Fire-resistance.

simple process is entirely successful; its requisites are a lack of resin (the pitchy quality) and the presence of a pleasing, natural figure in the grain. Another point related to plate V is that it simulates perfectly one of the natural, unstained effects that is regarded in the Orient as the acme of artistic simplicity and which proves its merits by its faculty of growing in the affection of those who live with it. It is, in truth, the wood itself, as the masters of art require, yet as applied to Redwood it yields an accentuation of natural beauty, with nothing added, which is superior to any comparison. Perhaps one of Redwood's best traits is its "habitual distinctiveness."

A House Hollowed from a Single Redwood Log at Eureka, California. It Takes Hundreds of Vears to "Erect" This Type of Residence. Two Rooms, Each 10 feet Square, with Ceilings 14 feet High. "Redwood Interior Trim." (Architect Unknown.)

IMPOSSIBLE TO BE COMMONPLACE, IF YOU USE CALIFORNIA REDWOOD

None know better than the Japanese how not to be commonplace. The avoidance of that particular fault is almost a religion with them. And, from the point of view of the American consumer, nothing is easier than the avoidance of the commonplace. He has but to specify California Redwood, whether for cottage or palace, and he is automatically guaranteed against "the taint of the uninteresting usual." There cannot be any "uninteresting average" in Redwood. It was of Redwood that a well-known writer





Another Glimpse of the Sublimities of the Redwood Forest. Observe the Relative Size of the Human Figure Leaning Against the Fifth Tree from the Right in the Photograph. Also the Luxuriant Man's-size Ferns in the Foreground.

said, "Every inch is a study and every foot is a picture." It is about the only wood in the world of which this can be said. There is a great difference not only in the character and texture but also in the superficial appearance of separate pieces of REDWOOD from the same tree. Even with the same method of sawing different boards of Repwood from the same tree will show not only rare and beautiful variations of grain, but-still more important—there may be variations of hardness or "texture" which require the exercise of thought, knowledge and somebody's experience in order to attain the best effects in finishing.



"Sequoia Cottage," Madison, Wisconsin. Summer Residence of F. M. Crowley, Esgr., Messrs. Gordon and Bach, Architects. Redwood Interior in all its Native Beauty; Redwood Exterior, including Shingles, Siding, Porch and Trim.

In the softer pieces the stain, or other preparation, penetrates deeper and more quickly than it does in the harder pieces. For example, Plate No. VII on page 37, shows an unusually hard piece of REDWOOD, of which it might be most difficult to procure large quantities at a given time. We state this to avert disappointment. It is plain that the "slash grain" sawing, such as is shown in Plates V. VI. VII. IX and X, is more likely to repel color infusions than are examples of "edge grain" such as Plates III, IV and VIII. Where the treatment has a chance to work in edgewise between the annular rings it naturally travels more readily



Chambers of the Late Federal Judge DeHaven, United States Government Building, San Francisco. Finished in Superbly Carved Burl and Curly Redwood. (Very Rare.)

than when it slides across the surface of flat layers of the wood. Please read carefully the general guidance to correct finishing which we offer in the Recipe Section.

(Text continues on page 40)











CALIFORNIA REDWOOD: "CURLY" GRAIN, SLIGHTLY WAXED

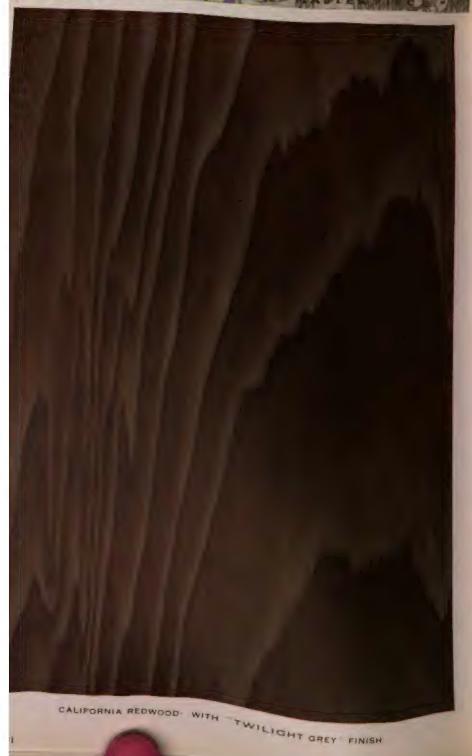


SIMPLE WEATHERED FINISH





CALIFORNIA REDWOOD: "JAPANESE BROWN" FINISH



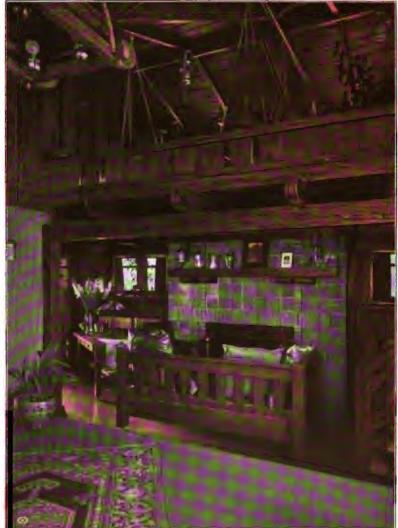




CALIFORNIA REDWOOD. WITH "COROT" BROWN FINISH

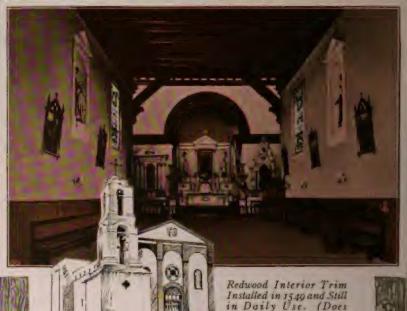
CALIFORNIA REDWOOD "CANYON GREY" STAIN WAXED

V111



The Music Room of R. M. Adams, Esqr., Los Angeles. All Trim and Timbering are of Redwood, Interestingly and Beautifully Finished. Mr. Arthur S. Heinemann, Architect. This Photograph Indicates Redwood's Wonderful Range of Use. Its Merits as a Structural Wood are Very Well Known.





Installed in 1549 and Still in Daily Use. (Does Redwood last!) Views of Mission Guadalupe, Ciudad Juares, Mexico. The Old Spanish Monks Recognized Redwood's Beauty and Adaptability.

AN "EASY-WORKING WOOD" MEANS REAL LABOR ECONOMY

One of the most notable virtues of Redwood as a standard high-class interior trim wood is the remarkable quality which cabinet-makers call "easy-working"—that is, it is "kind to edged tools" and tractable in the hands of the artist carver; if properly seasoned and worked, the "tongue" of the grain does not tend to rise on a "flat" or "slash" grain board; and these qualities assure not only enduring



The Homelike Charm of Redwood in "Livable" Houses. A Corner in the Tasteful Residence of Mrs. Sanderson, in Berkeley, California. (Messrs. Maybeck and White, Architects, San Francisco). The Panelling, Casings and Furniture (in fact, All the Wood you see except the Floor) are of "Nature's Lumber Masterpiece," whose Warm Tones Enrich the Almosphere of the Whole House. (And its Easy-working Qualities Especially Endear it to the Amateur Craftsman.) Redwood is Indeed the Ideal Wood for Varied Uses.

and always satisfactory service to the owner, but also in the building period save tremendously on the labor bill. (The wonderful over-mantel in the dining-room at "Darlington," [see page five] carved from a single piece of Redwood, superbly emphasizes the desirability of Redwood for all elaborate tooling.)

If Nature, when she created Redwood, had deliberately set out to most generously take account of our present-day economies and conveniences as well as our artistic appetites, she could hardly



Dining-room in the "Home of Redwood" at the Panama-Pacific International Exposition, San Francisco, 1915. Note the Rich Dignity of the Redwood Panelling,

have improved her work as it stands at this moment. In so far as the *de luxe* uses of Redwood are concerned, Nature achieved a miracle in making an "all-purpose" wood so richly adaptable to the more refined uses of lumber. She put into every Redwood tree a variety of kinds of grain, grade and texture probably not paralleled in any other species, and easily warranting Redwood's title as "The King of Specialty Woods."

In relation to Interior Finish this fact yields a fascinating range of choice which

BEAUTIFUL, ENDURING FIRE-RESISTANT, SANITARY



Living-room in the "Home of Redwood." Looking Toward the Dining-room. Do you Sense the Inviting "Feel" of the Redwood? No Other Wood has Quite this Quality. Mr. Louis Christian Mullgardt, Architect, San Francisco.

is only remotely suggested by the diversity of the color-plates in this book. It is interesting to note that the handsomest and most durable kind of Redwood for Interior Finish comes from near the butt of the tree. This is always the hardest section, and, while so very superior for Inside Trim, is not as good for patternwork; and so it goes, all through the varied catalog of the product of a single Redwood tree.

Do not fail to remember that the various treatments suggested in this book are

always much enhanced in beauty and distinction when applied to the *harder* examples of Redwood. The selection and discrimination must be left to the intelligent and vigorous judgment of the individual buyer in securing the particular stock which will best meet his needs.

An interesting commentary is the fact that RED-WOOD, the only species of wood in the world which grows only in the United States, has, hitherto, been much more appreciated abroad than at home. Upward of fifty million board-feet annually are exported to Australia alone (a sparsely settled land), and are there almost entirely applied to fine Interior Finish and Doors. (May we not hope that America itself, the home of the most beautiful, most individual, most romantically historic, most tractable and most universally useful and economical wood in the whole catalog of forestry, will soon awaken enthusiastically to this native treasure which it has been neglecting? And is it not singular that while the majesty of the Redwoods is a familiar thought to almost any American, their utility is so little realized by most people? What more interesting than to feel that the beautiful wood which helps to house you was a vigorous sapling at the time of the Crusades -and that it is now yours, in the most practical of service?)

A point worth remembering, and which pertains to all species of lumber, is that the harder the wood the greater is the occasional tendency to split (more or less, according to texture). Your insistence upon carefulness in nailing the harder examples of Redwood should, therefore, be in proportion to the character of the particular board—which even an amateur judge can intelligently discern. The usual run of Redwood is practically "split-proof."



BEAUTIFUL ENDURING FIRE-RESISTANT SANITARY



S. S. "Seeandbee," of the Cleveland and Buffalo Transit Company. The Largest and One of the Handsomest Side-wheel Ships in the World. The Staterooms, Partitions, etc., and the Canvas-Covered Decks, are of California Redwood.

WIDE REDWOOD PANELS ARE ALWAYS PROMPTLY AVAILABLE

Another advantage offered by California Redwood, alone among all the woods of the Earth, is the fact that it can be had in such astonishing widths at such very reasonable prices. Reference to the photograph of the dining-room on page thirteen will be most impressive. These edge-grain panels are five feet wide, and keep their position without either shrinking or swelling. (This is the "stay-put" quality which puts Redwood almost in a class by itself among all interior trim woods, either hard or soft.) Mr. Hobart's panels, warm greyish-brown in tone, (acid stain), are

"glued up." This singular freedom from the faults expected in most woods is one of Redwood's distinctions. Another point is that the natural figure of Redwood varies so much, and is always so beautiful, that marvelously lovely and distinguished effects may be had with the ordinary run of the grade known as "clear finish" without resort to specially selected stock for even very particular panelling work.

THE USE OF REDWOOD "SHORT LENGTHS" IS HIGHLY INTELLIGENT ECONOMY

A skillful, artistic and most intelligently economical utilization of REDWOOD is illustrated on page fourteen. The owner made wonderful use of "short lengths" of ordinary REDWOOD stock-"ship-lap." 1 inch by 8 inches by 8 feet—obtainable anywhere, any time, and always at materially less cost than "standard" lengths. What is the difference? It is little more than habit and superstition. wood is the same. Why do people insist on buying 14-foot lengths and then cutting them into two 7-foot pieces for door-casing, for instance? Probably because the habits of the trade are strong, and the purchaser is not familiar with the advantageous facts here submitted. The opportunities to economically utilize "shorts" for interior finish are diverse and frequent—and the savings are very considerable. This is especially true when widths from 3 to 8 inches can be employed; where 10 inches or wider is really necessary you must not expect to secure them so easily in short lengths; the wider stock naturally commands a superior market in greater lengths and is cut as long as possible in all cases. Yet if the conditions of your proposed use admit of

BEAUTIPUL ENDURING FIRE-RESISTANT, SANITARY



The Dining-room, "Three Rivers Farm," Dover, New Hampshire. Country Estate of E. W. Rollins, Esqr. Finished in California Redwood. Note the Great Width of the Ceiling Boards. Messrs. Chapman and Frazer, Architects, Boston.

"matched up" work, the marvelous product of the "Linderman" machine used by many of the better woodworkers will be available in almost any dimensions desired.

In connection with the subject of short lengths, in general, it should also be remembered that "shorts" thicker than 2 inches are always scarce.

All these facts are worth remembering—and we are being very candid with you, Mr. and Mrs. Reader, because we might reasonably follow the historic practice and

allow you to pay more than you really need to for the material you require. "Short lengths" are cheaper per foot as well as more economical in use. But if we followed the usual course, it would not be in accord with the spirit of this Redwood book, nor with our hopes for your permanent confidence and respect. In the same direction, we are glad to state here frankly that the "select" grade of Redwood "finish stock" (the principal "defect" in which is healthy "sap-wood" on the edges) can be bought at from \$3.00 to \$5.00 reduction from the standard prices for "clear" grades, and is just as good for paint and enamel work as the most perfect "clears."

It may be well to say here that the word "defect" in lumber grading-rules signifies the presence of some definite and obvious characteristic and does not at all necessarily imply undesirability. For instance, "clears" must have no knots, while in the next grade (equally valuable for almost every use) "tight" knots up to a certain size are not described as a "defect." What is a "defect" in one board may exist in another board which is classed as perfect (in its grade). The word "defect," therefore, in lumber parlance merely aids in arbitrarily classifying a varied output and is not in any way a disparagement if you buy the grade that best serves the special use. There is no object in buying "No. 1," for instance, for purposes which "No. 2" would serve just as well, and would cost you less.

In the upper grades of most lumbers, "sap-wood" is technically a "defect" because of its lesser solidity and greater tendency to early decay than the "heart-wood" of the same tree. In the process of sawing, a board often shows both "heart" and "sap" and this affects both its grade and its price. The sap-wood is the newer growth, next to the bark.

In most white woods the sap-wood shows but little contrast with the heart-wood, and is therefore often tolerated in the higher grades because it is hard to distinguish. But in REDWOOD the color tone of the heart is so much darker than the sap that when you specify "clear" you inevitably get exactly what you wish—neither error nor manipulation being possible. There is not a blemish in it. This is important. Perhaps you begin now to realize the spirit in which this book is written, and we hope you will profit by it.





IN LONG, ROUGH USAGE REDWOOD GETS STRONGER INSTEAD OF DECAYING

An interesting testimony to the longevity of Redwood under hard conditions is in the following extract from the West Coast Lumberman, published in Seattle, Washington, a locality not specially interested in the welfare of Redwood. We offer the publishers our compliments on their candor, and reprint their statements for the benefit of the public:

"AN INTERESTING TIMBER TEST."

California Redwood lumber acquires added strength with age, according to tests which have been made at the University of California. Timbers taken from a house built thirty-seven years ago on the Berkeley campus were tested and found to be actually stronger than the day when the building was erected. There was not the slightest indication of decay in . . the REDWOOD, having been nearly perfect. Air seasoning had taken place under the most favorable circumstances. The only evidence of age was the fact that the wood was slightly darkened. The house from which the lumber was taken was built in 1874, and was wrecked to make way for improvements. . . Mr. Shields, who conducted the tests, found that the 38 year old Redwood had a longitudinal crushing strength a fourth greater than Redwood which had been air-seasoned for two years."

(Like a good book [may we include this one?], and several other good things in life, REDWOOD improves with age).

Perhaps one of the most notable of the traits which distinguish Redwood is its peculiar quality of Fire Resistance. No other American wood (and perhaps no other anywhere) approaches Redwood in this remarkable trait. Of course it will burn—all wood is combustible—but, owing to its singular freedom from resin and pitch, and more particularly to the presence of a rare and characteristic acid, Redwood ignites reluctantly. So well is this fact established that after the San Francisco earthquake and fire, the Building Committee of the city, appointed by the Mayor to determine the character of buildings and materials to be used in reconstruction, adopted the following resolution: "Resolved, that no permits be given at the present time for the construction of any buildings in San Francisco, but owners of property

REDWOOD LUMBER MAST

will be allowed to proceed and erect upon their premises temporary one-story buildings, constructed of galvanized iron OR REDWOOD without a permit." The Hardwood Record (Chicago) says, "Three woods which have wellestablished reputations for being hard to set on fire are holly, Redwood and European alder. California Redwood will scorch and char to a considerable extent before it will burst into flame. Firemen in western towns where REDWOOD . . . know how much easier is the work is much used of controlling a fire where this wood is concerned than where the material is pine . . . REDWOOD instantly absorbs water . . . and a surface that is blazing may be quickly freed of flame." Further testimony on this singular point is found in a letter from Mr. P. H. Shaughnessy, Chief Engineer, San Francisco Fire Department, in which he says: . . . After an experience of twenty-two years my observation convinces me that under similar conditions of heat exposure Redwood ignites much less quickly and burns much more slowly than pine or other kinds of resinous In the great San Francisco Firewe succeeded in stopping it in nearly all directions where the unburned buildings were almost entirely of frame construction, and if the exterior finish of these buildings had not been of REDWOOD I am satisfied that the area of the burned district would have been very greatly extended." The New York Record and Guide, of October 14th, 1911, stated editorially that "A good deal of REDWOOD is now being used in neighboring towns for siding frame dwellings REDWOOD has long had the reputation of being ONE OF THE SLOWEST WOODS TO BURN and for that reason ONE OF THE SAFEST MATERIALS for wooden houses . and is SO ABSORB-ENT THAT IT TAKES IN WATER ALMOST IMMEDIATELY, SO THAT A REDWOOD HOUSE ON FIRE MAY BE SAVED when a pine building in the same situation could not be." "REDWOOD . . . is a great fire resister," says a writer in Country Life in America, (New York), for October, 1915. (Fame spreads). It is likely that this same acid, peculiar to this species, accounts in large part for the defiance of REDWOOD to the elements of time and weather and multitudes of parasites, which, in turn, also explains its wonderful resistance to all forms of decay that afflict most kinds of lumber.

Its "sturdy honesty" is further indicated by a letter from Messrs. Murray M. Harris Company, organ manufacturers, who state that they have found REDWOOD "especially



adapted to our purposes. It is not susceptible to atmospheric changes, there being practically no swelling or shrinking after it is once thoroughly dried, which makes it a very reliable wood . . . It being free from pitch, we are not troubled with sticking valves."

Another interesting fact, not specially related to interior trim, yet of positive value to every prospective homebuilder, or home re-vamper, is the extent of the supply of REDWOOD. This might affect both the ease of securing it and the price to be paid for it. Complete reassurance on this point lies in the fact that conservative estimates, as issued in Government reports, indicate considerably over one hundred years of REDWOOD at the present rate of cutting, without taking into account either the growth of present standing trees or the prolific propagation natural to this species, nor yet of the sincere and intelligent efforts in the direction of conservation. In a practical sense, the supply of Redwood may be assumed to be perpetual, and its price may, therefore, be expected to always remain at an exceedingly moderate figure, when compared with other woods of far less value and distinction.

Taking the whole subject together, it is an inevitable and conspicuous deduction that when the architect, homebuilder, or decorator puts Redwood into a house, he has a most unusual opportunity to distinguish himself in working out color schemes; it is almost as though he were an artist in some other direction, and had a canvas upon which to work. The point is, that there is no limitation upon an artistic impulse in the handling of Redwood. Redwood will take any finish that any other wood will take, and some that no other wood will take. By reason of its porousness it takes stain readily and the stain penetrates so thoroughly, that any damage to the surface does not show as much as might be feared, because the pinkish color of the natural wood does not show through the stain. Another vital point is the practically total absence of resin and pitch.

REDWOOD is singularly well suited to all kinds of paint and enamel work, and it does not require any more paint, if as much, as do ordinary woods. High class jobs of white enamel on REDWOOD, with hand-rubbed finish, have lasted as long as twenty years in many recorded cases without repainting. The freedom of REDWOOD from shrinking and swelling tends to assure against unsightly cracks in enameled work.

In working details of interior finish out of Redwood care should be taken to avoid sharp corners as much as possible, as it is comparatively a soft wood. Natural round effects are prettier, they give less opportunity for dust to collect, and there is less chance of their being bruised or dented.

It is the opinion of the publishers of this book that the silvergrey stain is one of the most important bases for artistic variance which has yet been applied to any soft wood. It is original with us and we give it to you freely, and with the statement that varying shades and effects may easily be produced at slight expense by the exercise of a little personal care, skill and artistic judgment. It is a singular fact, as indicated in some of the stain recipes in the following pages, that this basic grey stain finish can be worked into a great many other color effects, because it practically cancels the natural reddish tone of Redwood (to which some people demur, although others think that nothing in the whole world of wood is more beautiful).

The same wonderful varieties of tones are attainable with the OIL FINISHES which we have developed for special application to Redwood. After exhaustive experiments by some of the most skillful artists in the country, we present these recipes with not only confidence but with genuine pride, to all friends of "Nature's Lumber Masterpiece" who wish to use it in its widest and loveliest adaptabilities.

We commend the generous reader to the following pages of recipes, in the faith that he and she will find, sooner or later, that California Redwood has entered their consciousness affectionately and ineradicably, and that hereafter they never will doubt that Redwood is the best and most beautiful soft wood interior finish to be had in the world's lumber market. Try it. You will be glad we told you about it.

CALIFORNIA
REDWOOD
"NATURE'S
LUMBER
MASTERPIECE."

A



CALIFORNIA HEDWOOD "NATURE'S LUMBER MASTERPIECE."

Directions for Rare finishes edwood

GENERAL INSTRUCTIONS:

The most vital single requirement in the artistic finishing of RED-WOOD, (aside from good millwork) is that it must be prepared with patient and affectionate care before the color finish (if any) is applied. The surface of each piece must be scraped and sandpapered with the grain until it is perfectly smooth. Although REDWOOD can be made to simulate almost every known hardwood, it is naturally a soft wood, and requires a caressing treatment-whereupon it will do almost anything you ask of it. PROBABLY THE MOST ARTISTIC of all finishes that can be applied to REDWOOD (in the eyes of most people) is that which merely protects and perpetuates its native beauties. The most important parts of the process are patience and "elbowgrease." The most lovely effects hinge on plenty of "arm-work." The simple wax finish is a wonderful success if "well-mixed with patient and repeated rubbing." (Recipe for Plate No. 2.) OUR MOST IMPORTANT SINGLE SUGGESTION is that proper preparation of REDWOOD is vital. sincerity of purpose on your part as much as sincerity of advice on ours. Patience and care will pay high dividends. UNDOUBTEDLY THE SWEETEST FINISH of REDWOOD is achieved by preserving instead of trying to alter or enhance its natural beauty. "Its loveliest finish is no finish." Next to this in simplicity is the simple wax finish, and third is the waxed shellac finish, which possibly is more durable than the simple wax finish. To produce the waxed shellac finish a very light coat of pure white shellac should be first applied. The shellac should be thinned with alcohol until it runs freely. This will not materially alter the color of the wood. (All standard "fillers," etc., have a tendency to darken the wood.) After the shellae has set, rub with very fine sandpaper or mineral wool

REDWOOD HATER

and apply two coats of wax as directed in Recipe 2. This will show up particularly well on REDWOOD burl, curly, bird's-eye, or any fancy grain. Neither of these finishes yields a very high polish, but will give a very artistic gloss which is easily maintained by occasional rubbing with a soft cloth. If time or wear dims it, the original finish is restored by a light coat of wax

and another good, honest rubdown.

REDWOOD "burl," or "curly," will take a "piano polish."

Will any other "soft" wood do this? The "hard-grain" parts of

REDWOOD, (perhaps from the same tree as the richest "soft"

pieces) will take as high a finish as the rarest hardwoods.

(One of the peculiar virtues of REDWOOD—worth remembering.)

A WAX FINISH gives better results and keeps the color of the stain, while the varnish sometimes changes it and drives the stain further into the wood. Again, a wax finish is more popular today and is considerably less expensive to apply.

NAIL HOLES SHOULD NOT BE PUTTIED until after the first wax coat has been applied; otherwise the oil in the putty will sink in and darken the wood around the nails. For the best effects no stain should be applied until after the REDWOOD has been thoroughly cleaned and prepared, and then, after the stain is dry, it should be followed by two coats of wax, applied as elsewhere directed.

For a high varnish finish, apply the stain first, and after thorough drying, a thin coat of "drying varnish" and two or three coats of "rubbing varnish." Rub in pumice stone and water, and oil off, or rub in pumice stone and oil and clean up carefully. This will give a beautiful "dull finish." The varnished finish will tend to "bring out" the grain more definitely, and is perhaps more permanent, yet is not usually preferred. For an inexpensive (and easy) "rubbed finish," use stain of the desired tone, one coat of shellac and one coat of "flattine."

A VERY IMPORTANT POINT is that stains must be QUICKLY and lightly applied in order to avert patchy effects where brush-marks overlap; it is also a worth-while fact that any of the dyes or stains ordinarily used on other woods can be successfully used on REDWOOD. REDWOOD is naturally absorbent, and free from the repellent resin. Any dye that will color cloth in a water solution will stain REDWOOD, and any of the reliable stains on the market can be successfully applied to REDWOOD.

CAUTION; For the desired effects all recipes herein given should be developed to your satisfaction on samples of REDWOOD BEFORE being applied to the permanent surface. They are in successful use by the best decorators and will give the fullest satisfaction if properly and intelligently followed.



WE DIRECT YOUR SPECIAL ATTENTION to the recipes for OIL FINISHES on REDWOOD. (See page 58). These were devised by Mr. Louis Christian Mullgardt, an architect of national eminence, and were employed under his personal supervision in the \$12,000 bungalow known as "The Home of Redwood," at the Panama-Pacific International Exposition, at San Francisco, 1915. The success and popularity of these new and beautiful OIL finishes led us to include them here for your benefit. First, however, we will identify and give the recipes for the ten 5-color pages in this book:

ARTISTIC RECIPES (EXCLUSIVELY OURS): (Please refer to color plates mentioned.)

PLATE No. 1: (page 31): NATURAL REDWOOD—No FINISH: A color photograph from the natural wood, entirely without either filler or finish. A "hard" example of semi-curly REDWOOD, unusually light in tone. Different pieces vary in their natural tone. This contributes to their art value.

PLATE No. 2: (page 32): NATURAL WAX FINISH ON REDWOOD: After the wood is carefully prepared as indicated in "General Instructions," apply two coats of any good wax thinned out in the proportion of 1 pound of wax to 1 gallon of turpentine; allow 24 hours for drying between coats. When last coat is dry, rub carefully with a stiff brush and finish by a patient rubbing with a soft cloth.

PLATE No. 3: (page 33): NATURAL REDWOOD WITH VARNISH FINISH: See that the surface is smooth and carefully dusted. In putting on the varnish special care must be taken to keep out dust as much as possible until the varnish has thoroughly dried. Apply a coat of varnish, and when entirely dry, sandpaper with No. 00 sandpaper; then apply at least two good coats of "rubbing varnish." Allow 48 hours or more for drying between coats. A slight sandpapering is also required between coats, the last coat to be rubbed with pumice stone and water or pumice stone and oil.

PLATE No. 4: (page 34): SIMPLE WEATHERED FINISH: Dissolve ¼ ounce picric acid in 1 gallon of hot water or 1 gallon of denatured alcohol. This acts as a bleach to take out the natural pinkish color of the REDWOOD. When dry, finish with two coats of wax, mixed with a little burnt sienna and Van Dyke Brown, as indicated in the Natural Wax finish. (No. 2)

Note—A great variety of other colors can be produced after using the pieric acid, by the admixture of other pigments in accordance with the taste of the decorator and as required by the color scheme desired.

PLATE No. 5: (page 35): JAPANESE BROWN (burnt) FINISH: This is the "flame treatment," illustrated by a rather unusual piece of Redwood. Sample shown is an exceptionally "hard" piece, and the result is an unusual contrast of tones between the "hard" and the "soft" wood. (Yet you might find many like it.) The process is simplicity itself. You merely scorch the surface of a piece of "raw" REDWOOD board with a gasoline torch such as plumbers use, then brush out the char with any stiff bristles, and clean with a soft cloth dipped in alcohol. You may then lightly wax the surface if you wish, but this is not strictly necessary. The result is a graphic emphasis of the natural grain, and a novel impression is certain, as you seldom will duplicate effects in apparently similar boards. The plate shows a hard slash-grain piece, but the same treatment may be applied to vertical grain with equally beautiful results.

PLATE No. 6: (page 36): "TWILIGHT GREY." To get the effect shown in this plate "hard" REDWOOD stock must be used. Apply solution made by dissolving 1 ounce of bichromate of potash in 3 pints of water, then wash with a grey white lead stain; this may be finished with either shellac or varnish. On "soft" REDWOOD stock, (which is oftenest met with), a similar effect is obtained by using the Silver Grey stain (see plate No. 10), then the bichromate of potash solution on top, (but do not use any finish as this will tend to drive the coloring matter too deep into the

pores of the soft wood).

PLATE No. 7: (page 37): "COROT BROWN:" This most nearly suggests the tone of Circassian Walnut. It should be applied only on hard stock. Saturate 1 quart of 26 degree crude ammonia with 4 ounces of tannic acid, shaking the powder into the ammonia, until a complete precipitate is formed in the bottom. Follow one application of this with a wash of bichromate of potash, dissolved 1 ounce in 3 pints of water. Wax as directed in other cases.

PLATE No. 8: (page 38): "CANYON GREY:" Thoroughly mix 1 gallon of water with 1 ounce of lye (potash), apply one coat of this solution and let it stand for 2 days, until it thoroughly bleaches; then wax as previously described. Many different effects may be produced by using different pigments, dyes or stains after first bleaching the surface of the wood with lye. Individual experiments in such a case may evolve novel and beautiful results not known even to us or the "experts."

PLATE No. 9: (page 69): "AUTUMN GREEN:" This effect is made by first applying one coat of the Silver Grey Stain, (see Recipe No. 10) and when this is dry, applying one coat of picric acid, mixed 1/4 ounce of picric acid to 1 gallon of hot water, or 1/4 ounce of picric acid to 1 gallon of denatured alcohol; then wax and finish the same as for Silver Grey.

PLATE No. 10: (page 70): SILVER GREY: Bring to a boil 4 ounces of verdigris powder with ½ gallon of strong, cheap vinegar, or diluted acetic acid. Bring to a boil 2 ounces of nutgall powder, with ½ gallon of water. Mix the two and add 10 ounces of soapstone powder; keep stirred and apply to the wood with a brush. If not grey enough when dry, apply a second coat. Next brush off all loose powder and apply the following mixture: 4 ounces of pure beeswax to 1 gallon of pure turpentine or benzine. Then putty all nail holes. Mix the putty three shades darker than the wood color. Use plaster of paris to stiffen the putty; let the putty dry for 24 hours and then apply a second coat of the wax. When dry, polish with a brush and finish off with a cloth.

CAUTION—The verdigris and nutgall powders are to be cooked in and used from agate or enamel pots, free from tin or iron. Keep your stains in glass jars, as the acid will eat the agate in a short time. The rule as to the waxing and puttying of stain No. 10 will apply to all the other special stains except where otherwise specified.

THE FOLLOWING RECIPES (Exclusively Ours): ARE FOR STAIN FINISHES NOT SHOWN

in color in this book, but which can be relied upon to yield artistic, interesting and satisfactory results if carefully executed:

DARK GREY: Use formula for Silver Grey, but omit the soapstone. The more soapstone, the lighter the grey becomes.

FRENCH WALNUT: Two coats of Silver Grey stain as already shown. When dry, sandpaper smooth with polishing paper; dust off and apply one coat of any good dye (orange color) dissolved ½ ounce to 1 gallon of water. When dry, rub lightly with polishing paper, then wax and putty.

WALNUT Brown: Finish the same as the French Walnut, but use a seal brown dye instead of orange color dye.

Note—This Silver Grey Stain may be used as a basis for a great many fine effects, the final color being determined by the color of the dye used.

DARK WALNUT: Dissolve 4 ounces of verdigris powder in ½ gallon of strong vinegar; then add 8 ounces of dry French

zinc; 3 ounces of raw sienna, dry; then 2 ounces of burnt sienna, dry; then 2 ounces of golden ochre, dry; keep well stirred and apply an even coat. When dry, give one coat of any shellac; sandpaper carefully and wax.

AMERICAN WALNUT: One coat of Silver Grey stain. When dry, apply one coat of bichromate of potash solution. (1 ounce of bichromate of potash dissolved in 3 pints of water.) Wax and finish the same as stated in other cases.

GOLDEN BROWN: One coat of Silver Grey stain; when dry, one coat of potash stain as above. When dry, one coat of picric acid stain. Wax and finish as in other cases.

MAHOGANY: (IMPORTANT: VERTICAL GRAIN STOCK MUST BE USED.) Mix Bismarck Brown in water and apply; then use one coat of shellac; sandpaper it well; then glaze with spirit stain, using as a pigment Bismarck Brown and spirit black. This will produce a dark Mahogany color. Finish with two coats of any standard brand of varnish, rubbing each coat down with oil and pumice.

Note—Because of its natural reddish tone REDWOOD approaches much nearer to a true mahogany effect than does any other soft wood; this is particularly true of the curly grain examples.

LIGHT OAK: Dissolve 4 ounces of tannic acid by adding it slowly to 1 quart of 26° ammonia. Give the wood one coat of this after it is thoroughly dry. Sandpaper with No. 00; then one more coat of above solution. When dry, sandpaper and finish with wax as elsewhere described.

THE FOLLOWING RECIPES (Exclusively Ours): ARE FOR OIL FINISHES NOT SHOWN

in color in this book, but which can be relied upon to yield artistic, interesting and wonderfully satisfying results if intelligently and carefully applied. "Patience pays dividends."

IMPORTANT PREPARATIONS AND METHODS: After the wood is thoroughly sanded and cleaned smooth, apply a coat of white shellac; then mix pigment of whatever color is desired with white lead or zinc and boiled oil, thinning the mixture with turpentine if necessary, and applying with a brush. Immediately thereafter, while wet, wipe with a soft rag, cheesecloth or dry brush, leaving a thin film of color and allowing the Redwood grain to show through uniformly.



This process may be repeated until the desired tone is obtained uniformly, allowing each coat to dry thoroughly before the next application. After a satisfactory uniform finish color has been established, wax with two coats applied hot and rubbed to surface finish desired.

Any color tone may be produced, the variations simply depending upon the pigment, the mixture and quality of workmanship.

"NATURAL" FINISH: (respectfully suggested for the RECEPTION HALL): Two coats of white shellac, thinned with grain alcohol, applied with a brush and then rubbed with beeswax.

A Suggestion for the Living-room: Two coats of white shellac, thinned with grain alcohol, applied with a brush; then one coat of silver grey OIL pigment applied with a brush and partially rubbed off with a soft rag (cheesecloth) and then rubbed with beeswax.

"California Brown:" (suggested for the Dining-Room): Two coats of white shellac, thinned with grain alcohol, applied with a brush; then one coat of walnut brown OIL pigment, applied with a brush and partially rubbed off with cheesecloth and then rubbed with beeswax.

WHITE ENAMEL: (suggested for the BUTLER'S PANTRY and KITCHEN): One coat white shellac, thinned with grain alcohol, applied with a brush, two coats of white lead paint and one coat of white enamel. (For the Servant's Quarters many people employ the same treatment suggested for the Butler's Pantry except that for the third coat white paint is used in place of white enamel.)

A SUGGESTION FOR A BEDCHAMBER: Two coats white shellac thinned with grain alcohol applied with a brush, two coats of pinkish brown OIL pigment applied with a brush and partially rubbed off with cheesecloth, and then rubbed with beeswax.

FOR ANOTHER BEDCHAMBER: Two coats white shellac thinned with grain alcohol applied with a brush, two coats mauve colored OIL pigment partially rubbed off with cheese-cloth and then rubbed with beeswax.

A SUGGESTION FOR THE SITTING-ROOM: Two coats white shellac thinned with grain alcohol applied with a brush, two coats golden brown OIL pigment applied with a brush and partially rubbed off with cheesecloth and then rubbed with beeswax.



NATURE'S LUMBER MASTERPIECE

> Arthur B. Weineman Arrhitert #27-431 Sun Fremah rn Main Sink E-blas

> > April 21, 1914.

Wy dear Mr. Browner

Replying to yours of the 18th inst., relative to my reasons for preferring reswood as an interior finish lumber as compared to other soft woods, I wish to state that my reasons are many and varied, and my preferences are rather high to analyze beyond stating that the general effect of the interior of a living or dining room finished in redwood produces a most satisfactory and restful effect, and the result of its use is so pleasadaply home-like, that I often choose it in preference to the more expensive hard woods.

I find that the great widths in which perfect and unblemished redwood boards can be obtained, renders it particularly attractive for uninecet and frieze.

I like the mubdued contrasts in the grain of the finished wood; and from the construction point of vice, its freedom from anothe and checks finders it greatly superior to other soft woods.

I use it extensively for interior finish because both in its natural color and in the various subtle tones and shadnes that can be produced by proper staining, I find that it harmonizes with and picks up almost any interior decorating schemes that are in good that. In short, I am a redwood erank.

Yours very truly,

ASR/B

ceritin Stein

BEAUTIFUL CALIFORNIA REDWOOD FOR FINE INTERIOR TRIM: "EVERY INCH A STUDY-EVERY FOOT A PICTURE."





Риноранов Мариманови Ринория Ансилового Риновия мурововия су маке там довем пт. стеблени TRANSPORT

Owner

November 11, 1914.

Crosby-Chicago, 206 South Highigan Avente, Chicago, Illinois.

Dear Sir:

I shall be glad if you can soon let me have the sample panels of California red wood which I saked you for yesterday and which I wish to have treated with a special method of finishing.

I am very much interested in the possibilties of red word for interior finish and have used it to advantage in several rooms during the past.

It has been particularly estimatory in the hall of the Michael Cudahy residence, Mackinso Island, a view of which you are publishing. I like it because of its workable qualities, because it will stay where it is put, because it has, in fact, so many of the excellent qualities of white pine with an added individuality in color and figure which suggests it use for passing, not as a substitute for nor an imitation of other woods, but for its own decorative value.

I do think that it, like many other fine woods, has had too little attention given to the methods of finishing which will bring out its beauties to the greatest extent.

Tours very truly,

PER PROPERTY

Juanian Tax

BEAUTIFUL CALIFORNIA REDWOOD FOR FINE INTERIOR TRIM:
"EVERY INCH A STUDY—EVERY FOOT A PICTURE."

CALIFORNIA REDWOOD

"NATURE'S LUMBER MASTERPIECE"



ERFENE & GREENE ANCHIPECTO (MICH. MICHAE BALLINI FRANCISCO CO. Destina Summer Gerral

Pasadens, Cal. April 30, 1914.

Redwood is a busutiful wood for interior work and may be finished in a great variety of ways.

Greens & Greene.

Willes Polk & Co. Architects San Francisco

на финасория и същина учения учения общения и подражения и подражения

BAN PERMITE BUILDING

April 23, 1914

Sentlement

In response to your inquiry as to our experience in the use of red-wood for Anterior findsh, would advise that so have found it to be atmirably adapted to this purpose. In the Pacific Union Club building, of this city, particularly satisfactory results were secured where redward was used in the special finish of several in the main rooms, the wood lending itself to fine results in staining and finishing.

Melly Partie

BEAUTIFUL CALIFORNIA REDWOOD FOR FINE INTERIOR TRIM:
"EVERY INCH A STUDY-EVERY FOOT A PICTURE."





LEWIS P. MONART, ARCHITECT CROCKER BUILDING, MAN FRANCISCO TELECHINE SOS MEANNY

Hidrodonie A. Holm,

April 24, 1914.

Gentlemen:

Referring to your inquiry as to what I think of redwood finish, I am pleased to state that I am using redwood for interior finish in a number of fine residences and consider it for all around purposes the best soft wood finish that is available. Not only is it free from pitch, but when properly seasoned it will not shrink or swell, consequently a job of redwood interior finish looks well not only to begin with but after it has been in use for a long time.

The wood is soft and easily worked and takes all kinds of stain readily. The natural color of the redwood is attractive and unusual and a great variety of different effects can be obtained by the use of acids, burning, lye, etc.

I believe

it is the mos' satisfactory material for a first class job of enamel work.

Yours very truly,

Mars ! Hertons

BEAUTIFUL CALIFORNIA REDWOOD FOR FINE INTERIOR TRIM:
"EVERY INCH A STUDY—EVERY FOOT A PICTURE."

CALIFORNIA REDWOD "NATURE'S LUMBER MASTERPIECE"

35 MONTGOMERY STREET SAN PRANCISCO, CALIFORNIA

Apr. 8, 1915.

Crosby Advertising Agency, Pullman Bldg.,

Chicago.

Gentlemen: -

Mr. Junius H. Browns has requested that we write you stating our reasons for using redwood as an interior finish. We have set forth some of our views in the following. There are other reasons, but we hope that the reasons we give will appeal to those who wish to build beautiful interiors.

We have used the wood frequently in the better rooms of small houses, firstly, from a desire to get away from the paint and putty tendency to cover up a multitude of imperfections, at the same time avoiding the cracks in plaster, which must be payared with wall paper and kept in constant repair. Secondly, by using the sanded natural redwood in simple boards and sattene, we obtained a rich looking room at a cost nearly the same is that of plaster

We often use the wood in olub houses and churches, and it is particularly good for concert halls, because, as the wood dries out and ages, it note like the shell of a violin. Left in its natural state, the bruises and scratches ultimately take the mane color as the wood, and therefore do not show. For the mane reason racms with redwood finish may remain for yours without changing, and should any one wish to renow the old corface, he can get a beautiful finish by sand-blasting. Very truly yours,

Maybeck & Maite.

perole.

BEAUTIFUL CALIFORNIA REDWOOD FOR FINE INTERIOR TRIM:
"EVERY INCH A STUDY-EVERY FOOT A PICTURE."



"NATURE'S LUMBER MASTERPIECE"

CHAPMAN & FRAZER
ARCHITECTS
MORACE S. FRAZER
Do. 441 WATER STREET

BOSTON.April 20th. 1915.

Osnilemen:-

Mr. Rolline has referred your letter of April 8th. to us.
We are mending you today a photograph, I have used a great
deal of redwood and elmost invariably finish it with a cost of oil,
touching up any light wood with a little stain, them a cost of
orange sheller, sandpapered, and a cost of wax thoroughly rubbed
in. I have found that this treatment gives the pleasantest results.

Yours very truly,

Chapman & Frazer,

H S. Fremer.

Comis Christian Muligardt I. A. I. A. Architect Chronicle Building

Ban Francisco May 28, 1915.

Erlegtung Kourna Sons

California dedwood Association San Prancisco, Cal.

Dear Sira:

I am pleased to indicate my appreciation for exceptional opportunities which your product efforts in the construction of buildings.

Redwood may be alvantagoously used in every manner in which other finishing woods are customarily used. It is renowned for its durability against the rawages of time. Structural and artistic effects are obtainable, differing from and surgonaling in quality many so called hardwoods. It is easy to fabricate and therefore insures economic results.

Very truly yours.

LCM:H.

BEAUTIFUL CALIFORNIA REDWOOD FOR FINE INTERIOR TRIM:
"EVERY INCH A STUDY-EVERY FOOT A PICTURE."

REPRINTED BELOW ARE LITERAL EXCERPTS FROM THE UNITED STATES GOVERNMENT REPORT (Department of Agriculture, Forest Service, 1911) on CALIFORNIA REDWOOD

(Sequoia Sempervirens)

PHYSICAL PROPERTIES:

Breaking strength (modulus of rupture). 8,000 pounds per square inch, on pieces 2 by 2 by 30 inches at moisture of 15.7. (Forest Service.)

Factor of stiffness (modulus of elasticity). 1,140,000 pounds per square inch, on pieces 2 by 2 by 30 inches at moisture of 15.7. (Forest Service.)

Character and qualities. Light, soft, moderately strong, brittle, grain fine, even, straight, sometimes curly; annual rings wide in the young timber, summerwood thin, dark colored, hard, conspicuous; medullary rays numerous, very obscure; color light to dark red, the thin sapwood nearly white; splits and works easily and polishes well; very durable in contact with the soil.

INTERIOR FINISH:

"As in house construction, so in interior finish, REDWOOD meets almost every use and requirement. Floors and ceilings are made of it, and wainscoting, panels, moldings, chair boards, brackets, shelves, railing, stair-work, spindles, balustrades and mantels. Formerly such work was often painted, and the grain of the wood was concealed, but the practice is now less common since the natural beauty of the wood is better appreciated. Its colors are rich and varied, and the finisher who understands the art of bringing out their best qualities can please almost any taste. It is a beautiful wood for carving, and is often so employed. The wood of all REDWOOD trees is not of the same color, nor are different parts of the same tree alike. The soil and situation where the tree grows have much to do with it. Shades range from light cherry to deep mahogany. Where the soil is light, the wood resembles Spanish cedar. Some grains are so straight that boards may be split 2 inches thick, 12 inches wide, and 10 or 12 feet long. (See foot-note.) In other cases the texture is so complicated and involved that all semblance to orderly wood is lost. Such wide extremes in grain and color give the carpenter and finisher their opportunity to make combinations to harmonize with nearly every kind of surroundings. Perfect boards of such width and length may be had that panels, shelves and counter tops of nearly any desired size may be made from a single piece. A panel of that kind has an added value, because the wood warps practically not at all, shrinks little and disfiguration from swelling need not be feared. If it is deemed desirable to darken the natural color of the wood, it can be done with oils. By well-known methods of treatment, imitation of rosewood and mahogany may be produced.

"The making of Redwood doors has been an important business. They are handsome, strong, light, and hold their shape well under changes of climate. Swelling and shrinkage, which give much trouble with doors of various other woods, are reduced to a minimum with Redwood.

"Note: There are buildings in the Redwood districts constructed of split boards, and so evenly is the splitting sometimes done that a rather close examination is necessary to discover that it is not the product of a sawmill."



"Come to the Sunset Tree" -Mrs. Hemans.

CALIFORNIA REDWOOD: "EVERY INCH A STUDY-EVERY FOOT A PICTURE."

The subjoined letter from an important lumber consumer in Lima, Peru, throws light upon one of the many characteristic virtues restricted to REDWOOD. The immunity of REDWOOD from the ravages of the "polilla," or white ant of the tropics, is a more valuable point than many may think. The white ant has extended his operations as far north as St. Louis, U. S. A., and has cost home-builders thousands of dollars. If they had used REDWOOD they would not even have risked this loss. U. S. Govt. Bulletin 95 says: "One of the chief properties recommending this [Sanitark REDWOOD timber . . . is its immunity from attack by white ants. The coloring substance in the wood is supposed to be the cause of it, and this timber is often, perhaps always, untouched where other timbers may be devoured."

Liena Lunepen Mills LTB.

LIEL - schilles A roser

A rose

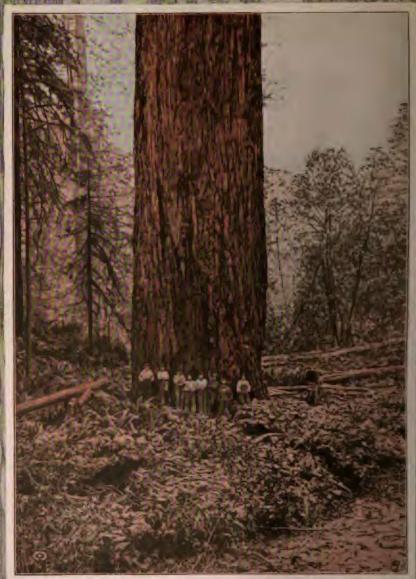
Door Sire:-

Replying to your favour of this date we have pleasure in stating that we have had a long experience of California Redwood & we have found it a most suitable hind of lumber for all purposes of Carpentry Work-We use it almost exclusively for Decre, Windows &c in our Pactory with the best results. It is easy to work & is not attached by the "politile" as in the case with white Pine & other soft woods.

Wishing you the compliments of the season,

We are, Yours very truly,



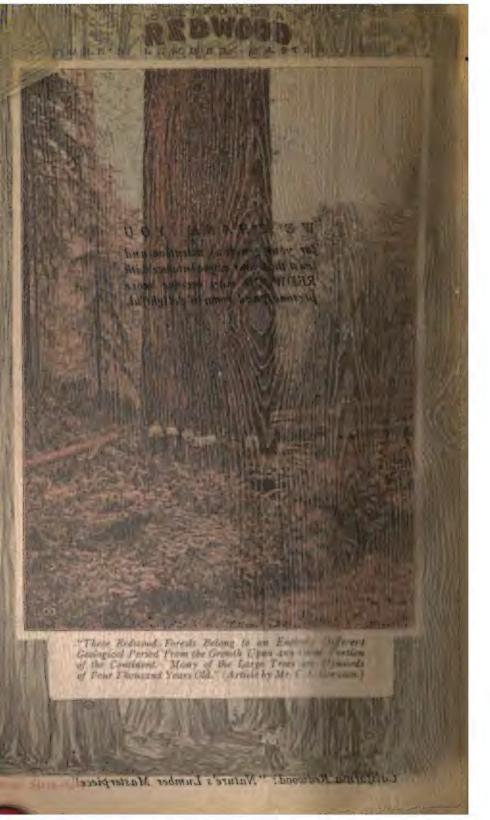


"These Redwood Forests Belong to an Entirely Different Geological Period From the Growth Upon any Other Portion of the Continent. Many of the Large Trees are Upwards of Four Thousand Years Old." (Article by Mr. C. L. Greyson.)

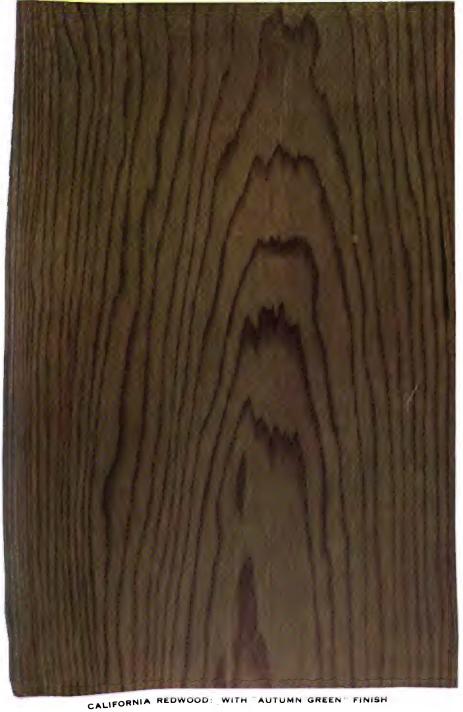




Californid Redwood: "Nature's Lumber Masterpiece"









CALIFORNIA STATE BOARD OF FORESTRY

CIRCULAR No. 6

WOOD UTILIZATION SERVICE



CALIFORNIA STATE PRINTING OFFICE SACRAMENTO 1918

CALIFORNIA STATE BOARD OF FORESTRY.

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WOOD UTILIZATION SERVICE.

Objects:

The objects of the Wood Utilization Service are to bring the producer and user of wood products closer together, and to furnish information regarding the utilization of wood and its products. The State Forester's office is constantly receiving inquiries about the character, uses and markets for wood products such as lumber, lath, shingles, posts, poles, ties, cordwood, veneer stock, tanbark, sawdust, charcoal, acetic acid and wood alcohol. The war has stimulated the demand for all classes of wood products, and it is evident that much assistance can be rendered to people producing and using these products through a Wood Utilization Service.

Special attention will be paid to the utilization of wood waste. There are manufacturers who are burning or giving away waste that might profitably be used by some other concern. The waste involved, for example, in making school furniture in an eastern factory was found to be exactly fitted for making scrubbing brush backs in a brush factory many miles distant. A veneer concern burned up the cores until it was found that they made excellent mine rollers. Shoe-lasts are being made from discarded tenpins, and knife-handles from the discarded waste of a maker of shuttle blocks.

There are good opportunities for the better utilization of much of our western timber. Hardwoods, such as oak, cottonwood, laurel, sycamore, manzanita and eucalyptus have been little used except for fuel, but there are indications that they are going to be used much more extensively for the making of wooden articles such as are now being brought in from outside the state. Some of our softwoods, such as Monterey cypress, digger pine and big-cone spruce are little utilized. Notes concerning specific uses of California woods will appear in circulars issued from time to

time. Any suggestions regarding their utilization will be

gladly received.

It is not the object of the Wood Utilization Service to serve as a brokerage office for the sale or purchase of extensive bodies of timber. All such inquiries which refer to the timber within the National Forests are referred to the U. S. Forest Service. Inquiries concerning timber properties outside the National Forests are referred to logging engineers, whose business it is to appraise timber and give advice on logging and milling methods. This office, however, will be glad to give advice to owners of small tracts of timber as to the value, uses and markets for their wood products. The wider use of wood for fuel to relieve the coal shortage is now being strongly urged by the Fuel Administrator. Any information which will assist in securing a wider use of wood for fuel will be gladly furnished by the State Forester.

Method:

Circulars will be issued as rapidly as the need arises, giving facts about wood products for which a market is sought, and the needs of persons who wish to buy certain kinds of stock. These circulars will be sent to manufacturers, woodworkers, manual training teachers and any one else who may be interested in the utilization of wood. Some of these circulars will take up such matters as the manufacture of charcoal and alcohol, tannins, wood distillation, and other products of wood about which information is constantly being sought.

There is no charge for this service. It is open to any one who wants to buy or sell wood products, or who desires information regarding them. Persons sending in items for publication in the circulars should be specific as to the amount, weight, dryness, price desired and accessibility.

Address all communications to the State Forester, Sacramento.

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UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

THOMAS FORSYTH HUNT, DEAMAND DIRECTOR
H. E. VAN NORMAN, VICE-DIRECTOR AND DEAM
UNIVERSITY FARM BONDOL

CIRCULAR No. 173 SEPTEMBER, 1917

THE CONSTRUCTION OF THE WOOD-HOOP SILO

By J. B. DAVIDSON AND J. E. STILES

The purpose of this circular is to explain briefly, yet somewhat in detail the construction of the wood hoop silo. Although prepared specifically to supply the demand for this information, prospective silo builders will no doubt desire a statement concerning the merits and limitations of this type of silo. For information concerning the size of silo to build, its location, and silage feeding, the reader is referred to this Station's Circular No. 138, "The Silo in California Agriculture."

THE WOOD HOOP SILO

The essential requirements of any silo are three in number, viz.:

- 1. An impervious wall to exclude the air and retain the moisture of the silage.
- 2. A smooth perpendicular wall, which will permit the silage to settle properly.
- 3. Sufficient strength and rigidity to withstand the bursting pressure of the silage from within, and the force of the wind from without.

The wood hoop silo will furnish all of these essentials with a minimum expenditure for materials. It has not the durability of masonry or heavier silos, nor the convenience of many commercial silos, except that in smaller sizes it can be readily moved from one foundation to another, a feature of some advantage to tenant farmers. It is not the best silo from the constructional standpoint, but it may be the best from the economic, as it is the cheapest, and furthermore can be farmmade from standard building materials sold at local lumber yards.

The wood hoop silo is one of the oldest types of silos in use, having been used in different parts of the country for more than twenty years. It is not to be considered an experimental structure in any sense.

Although it may be considered a temporary silo, the durability of the wood hoop silo will depend upon the selection of material and the workmanship used. Such silos have been known to be in use after fifteen years.



Fig. 1.—The wood hoop silo at the University Farm, Davis; 12 feet in diameter by 36 feet high, with 2-foot pit. Cost of materials, \$140.

CONSTRUCTION

The construction of the wood hoop silo is simple, for there are but three essential parts to the silo proper: (a) the hoops which resist the bursting pressure of the silage; (b) the diagonal braces between the

hoops which are needed to give the silo rigidity; and (c) the lining of tongued and grooved staves.

Shrinkage of the Staves.—No provision is made to take up the shrinkage of the staves which must necessarily happen in dry weather when the silo is empty. It has been fully demonstrated, however, that if the fiber has not been crushed, wood will always occupy the same volume with a certain moisture content. As each stave is nailed to



Fig. 2.—A wood hoop silo that has been filled three times. Cost \$120 and holds 120 tons of ensilage.

the hoops the shrinkage is evenly distributed and does not materially affect the rigidity of the silo. Dry lumber should be used, however, in laying up the wall to insure a perfectly tight wall when moist.

FOUNDATION

Under usual conditions concrete makes the best foundation for the wood hoop silo. Where frost does not interfere the foundation may be simply a ring of concrete, twelve inches wide, deep enough to get a good bearing, or about twelve inches, and high enough to place the silo six inches or more above the ground.

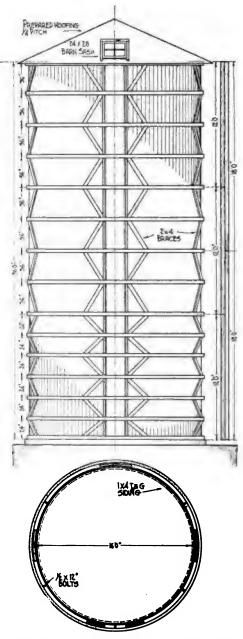


Fig. 3.—Plan and elevation of wood hoop silo.

Forms.—In making the foundation wall lay off two circles from a common center, as shown in fig. 4. The radius of the smaller circle should be four inches less than the radius of the silo and the radius of the larger circle eight inches more. Stakes may now be driven on

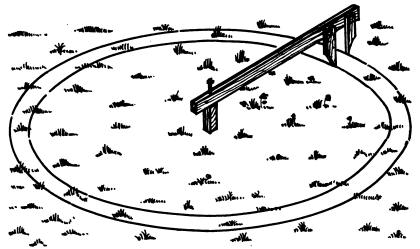


Fig. 4.—Laying out the foundation.

the line inside the inner circle and outside the outer circle. The stakes are then lined with thin lumber or hoop material, as shown in fig. 5, using care to make the top of the form, so prepared, level. A

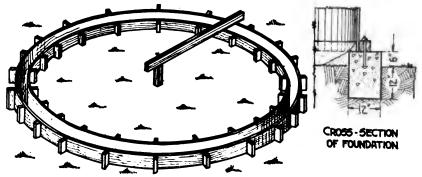


Fig. 5.-Form ready for concrete.

trench is then dug between the stakes so lined, twelve to fifteen inches deep, depending upon the condition of the soil, and the form is ready for filling with concrete.

Concrete.—The concrete should be made of a mixture of about one part cement, three parts sand, and four parts gravel or broken stone.

If mixed sand and gravel of good quality is available a mixture of one part cement to six parts mixed gravel may be used. The concrete should be placed wet and given at least a day to set before erecting the silo. In this case the inside of the foundation wall should be nearly flush with the inside of the staves.

Bolts.—Six bolts, $\frac{5}{8} \times 12$ inches for small silos, twelve feet or less in diameter, and eight bolts for larger silos, should be set in the soft concrete, equidistant apart, so as to come in the center of the hoops when placed and extending the height of the hoops above the concrete.

HOOPS

Material.—The material for the hoops may be any thin lumber free from knots, dressed to size, 3% to 1/2 inch thick and 23/4 to 4 inches



Fig. 6.—Making the hoops.

wide. Sugar pine, redwood, white cedar, and Douglas fir have all been used successfully. Batten stock which can be procured in all yards is quite satisfactory for the smaller silos.

Making the Hoops.—The first step in making the hoops is to make a master hoop. This is made on a floor, usually a temporary floor of two-inch lumber nailed together. A circle with a radius equal to one-half the diameter of the silo plus the thickness of the hoops when made and three layers of hoop material used in making the master hoop, is laid off on the floor. Triangular blocks cut with square ends are then nailed to the outside of the circle. These blocks are then lined with the three-ply of hoop material with the joints broken at the blocks and securely nailed to them. Care should be taken that the hoop material fits firmly against the blocks and that the blocks are not pushed away from the circle.

The hoops are then made by bending the hoop material inside of this master hoop, as shown in fig. 6. Swinging blocks or sweeps about two and one-half feet long are nailed inside of the circle to the floor, with one spike to act as a pivot; these are useful in holding the hoop material in place both in making the master and the regular hoops. The hoop material may be made to fit snugly by cutting the proper length and prying the ends together with a heavy chisel while being driven out against the master hoop.

After three plies of hoop material have been laid, nailing should start and continue after each ply is laid. The joints in the hoop material should be evenly distributed. The hoop may be pried from the master hoop with a crowbar or mattock. When half removed from the master hoop the upper part of the hoop should be nailed from the outside. Quarter points on the hoop should be marked and

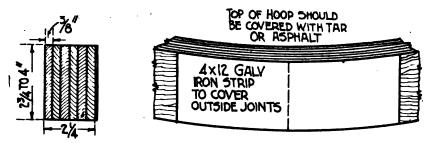


Fig. 7.—Detail of hoops.

numbered on the master hoop and each hoop marked therefrom. The master hoop can best be laid off by measuring around the outside of the first hoop made with a steel tape and dividing the circumference into four equal parts. These points so secured can be marked on the master hoop. The above quarter points are very useful in erecting the hoops insuring plumb and round silos.

The hoops should be well nailed from the outside when removed from the master hoop. The exposed joints in addition to being well nailed should be covered with galvanized iron or tin as shown in fig. 7. This can be done after the silo has been erected.

ERECTING THE HOOPS

Placing the First Hoop.—The first hoop should have strips tacked across it to keep it perfectly round. It is then centered on the foundation and the holes bored for the foundation bolts. It is best to bed the bottom hoop in rich cement mortar.

Guides.—Straight dimension pieces are set with one edge at three of the quarter points and carefully plumbed and braced in place. If

the quarter point marks on all hoops are placed on the same guide a round plumb silo is insured. The proper height of the hoops should be marked on the guides, according to the spacing given in the table which follows. One short guide is usually used to obviate the necessity of lifting the hoop over it, although this difficulty may be overcome at the start by placing five or six hoops on the bottom hoop before setting the guides and moving these up as the hoops are set.

Braces.—The braces, usually 2×3 inch material, are set at the quarter points to give the silo rigidity. Fig. 8 shows the shape and location of these braces. The braces should not be set flush with the inside of the hoops as they will lie slightly inside of the hoop line at

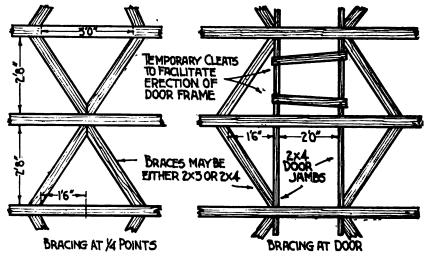


Fig. 8.—Detail of braces.

their mid-point and interfere with the laying of the staves. It is convenient to nail these braces together in pairs before nailing to the hoops. It is best not to nail the points of the braces securely until after the staves are nailed in place.

The use of these braces obviates the necessity of the use of a scaffold other than planks laid across the hoops. Care should be taken, however, to have the hoops well supported as the weight of the scaffold plank will cause the hoops to sag between supports. Short studs with braces are set at each side of the doorway.

The raising of hoops on account of their lightness will not be found difficult and can be handled easily by three men. The upper hoops can be pulled up with a rope. The frame so erected will resemble a large banana crate as shown in fig. 9.



Fig. 9.—Erecting the hoops.

THE STAVES

Material.—The frame built as described is lined with one-inch tongued and grooved lumber. Standard four-inch Douglas fir flooring or redwood ceiling may be used for this purpose although where a mill order is given the lumber should be milled full on the outside so as not to lay with an open joint. A so-called V groove is undesirable as it allows the air to pass down the silo wall. Redwood of good quality is considered the most durable material although not as stiff as fir. Sugar pine makes very satisfactory staves when a good quality of lumber is used. The staves are laid around the silo as a

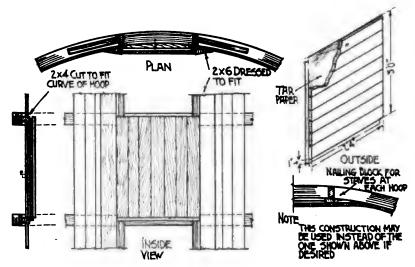


Fig. 10.-Detail of door frame and door.

floor would be laid. Each stave should be blind and top nailed with galvanized nails at every bearing except at the joints where the blind nailing will be sufficient. The joints should all center on the hoops and be uniformly distributed. Note the length of pieces which go together to make up the staves.

THE DOORWAY

The doorway is continuous, adding to the convenience of the silo. It is shown in detail in fig. 10. The staves are made to extend one inch past the door stude and the joints made by ripping a 2×6 diagonally are nailed on top of the staves.

SPACING OF HOOPS AND LENGTH OF STAVES

30-foot silos:

Total of thirteen hoops, 6-ply thick.

First seven hoops spaced 281/2 inches between centers for 12 feet.

Next six spaced 36 inches between centers for 18 feet.

Staves made of 18- and 12-foot pieces and 12- and 18-foot pieces alternately.

36-foot silo:

Total of fifteen hoops 6-ply thick for 10- and 12-foot silo; 7-ply thick for 14- and 16-foot silos.

First seven hoops spaced 24 inches between centers for 12 feet.

Next eight hoops spaced 36 inches between centers for 24 feet.

Staves made of two 18-foot pieces and three 12-foot pieces alternately.

42-foot silo

Total of sixteen hoops. 6-ply thick for 10- and 12-foot silo; 7-ply thick for 14- and 16-foot silo.

First ten hoops placed 24 inches between centers for 18 feet.

Next six hoops placed 36 inches between centers for 18 feet.

Staves made of 18-, 18-, and 6-foot pieces and 16-, 14-, and 12-foot pieces alternately.

THE DOORS

The doors can be made from two thicknesses of the tongued and grooved material used in the wall with tar paper between, or made cheaper by using shiplap or similar material. The door sections may be held in place with cleats across the doorway and holding the doors in place with a bolt at the center. Doors can best be made tight by setting in a bed of clay or adobe mud.

THE CHUTE

The chute is quite necessary and should extend from about six feet from the ground to the top. For economy it can well be built of plain barn boards. See fig. 11.

THE ROOF

A roof on a silo is not necessary, although it will protect and strengthen the silo, assist in preventing the silage from drying out, keep out rain and birds, and improve the appearance of the silo. It may be framed either to form a cone, as shown in fig. 12, or an octagonal pyramid and covered with shingles or prepared roofing. It is often convenient to build the roof after the silo is filled.

BILL OF MATERIALS

The following bill of materials does not include plank for a temporary floor on which to make the hoops or several pieces needed for

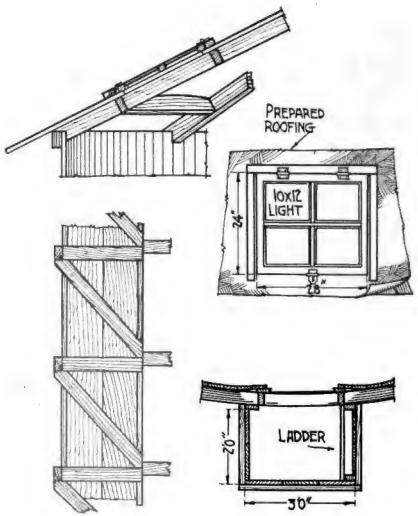


Fig. 11.—Detail of roof window and chute.

scaffolding. The temporary floor should be about two feet larger than the diameter of the hoops. One 2×10 or 2×12 plank for scaffolding will be needed for each six feet of height.

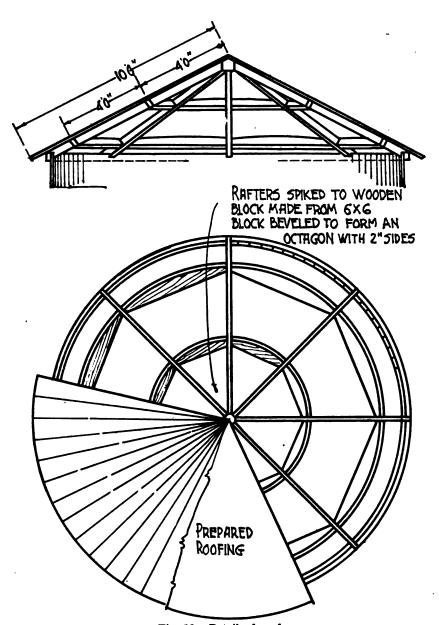


Fig. 12.-Detail of roof.

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ATERIAL	
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		DIA	DIAMETERS			
	Height	10 feet		12 feet	16 feet	14 feet
Concrete base, 1 to 6 mix-	30,	Eight sacks		Ten sacks	Eleven sacks	Thirteen sacks
sand is not sharp and clean.	8,3	pase on sau		same base	Bame base	same base
Hoop material, redwood or	30,	90 pcs. 18'	-	180 pcs. 20'	180 pcs. 16'	204 pcs. 18' 66 '' 16'
to size. Clear stock bat-	36,	105 (18'	, co	210 '' 20'	::	260 (118)
tens or I" X4" stock resawed and surfaced on	42,	::	63	240 '' 20′	::	
one side.		120 '' 16'			:	:
1" X4" T. and G. pine or	30,		-		:	;
redwood. Second grade		: :	_		: :	: :
pine flooring or clear red-	ò	: :	•		: :	: :
wood. Lining and doors.	20	168 (, 197	- 0	204 (4 19)		973 (6 19)
-		:			36 '' 14'	3
	42,	112 '' 18'	_		:	:
		;			:	:
					:	
		. 26 '' 16'	_			133 '' 14'
					:	:
g and rafters 2	30,	linear	4	linear	linear	ä
3" pine, surfaced one	36,	=	LC)		:	:
side and one edge. In 16', 18', and 20' lengths.	, 2	630 ((((•	650 '' ''	,, ,, 0.29	;; ;; 0 6 9
Chute lining rough common pine or redwood.	30,	×× 12,	12,5	•		
	36,	" 1" × 12"	.			
		, å	4 8			
		* × × × × × × × × × × × × × × × × × × ×	5 <u>4</u>			
	4 %	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	<u> </u>			
		,	<u>``</u>			
Sheathing for roof 1" × 6" common surface, one side.		15 pcs. 16'		20 pcs. 16'	25 pcs. 16'	32 pcs. 16'

MATERIAL FOR WOOD HOOP SILO—(Continued)

DIAMETERS 10 feet 16 feet Height 12 feet 14 feet Prepared roofing 2 squares 2 squares 3 squares 3 squares Door jambs made of 30' 60 linear ft. All diameters same. 2" × 6" surfaced 4 36' " " " " 42' sides and sawed diagonally. Lbs. No. Lbs. No. Lbs. No. Lbs. No. Nails: The No. 8 nails 30' should be galvanized. The remainder com-mon wire. 36' 42' R

Three pieces of tin or 28-gauge galvanized 9×12 inches for each hoop. Three or four guy wires with two eye-bolts for each:

36 feet long for 30-foot silo;

42 feet long for 36-foot silo;

48 feet long for 42-foot silo, should be provided.

Five or six strands of No. 2 wire make a good guy wire.

Posts will be needed to which to attach guy wires.

TREATING THE INSIDE OF SILO AND THE HOOPS

A coat of tar will improve the tightness of the silo. The less durable wood can be treated with creosote oil to preserve the wood. The silo can be relined on top of first lining when needed.

The top of the hoops where exposed to the weather can well be coated with heavy tar to protect them from moisture.

GUY WIRES

The silo is a light structure with a large amount of surface exposed to the wind. To protect it when empty, it must either be attached to adjoining buildings or thoroughly guyed to properly set posts. Failure to do this will often result in the destruction of the silo.

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CONTROL OF THE POCKET GOPHER IN CALIFORNIA

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Contribution from the Museum of Vertebrate Zoology
University of California

II. A Method of Poisoning Pocket Gophers
By E. RALPH DE ONG

Agricultural Experiment Station, University of California

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I. NATURAL HISTORY OF THE POCKET GOPHER VARIOUS METHODS OF CONTROL

BY JOSEPH DIXON

Contribution from the Museum of Vertebrate Zoology, University of California

The damage done by the pocket gopher in the United States has been estimated at over twelve million dollars per year.¹ California is one of the chief losers. The depredations by the gopher are locally numerous, involve nearly the entire state, and go on all the year. The losses, taken one by one, may be trivial, but in the aggregate are considerable. These features all taken into account lead to the belief that more damage is done by the gopher in this state than by any other one animal, not excepting the ground squirrel or the coyote.

NATURE OF THE POCKET GOPHER

The pocket gopher is a small, chunky, short-legged, burrowing rodent, with large protruding front teeth, fur-lined cheek pouches, which are used to carry food, not dirt, and which open outside the mouth, small ears and eyes, and short tail, often naked at the tip. The gopher averages smaller than either the common house rat or the wood or "trade" rat, but there are often great differences in size, especially between the sexes. Because most of the gopher's work is done in the dark, either underground or at night, the disastrous results are better known to most people than is the animal itself.

THE POCKET GOPHER COMPARED WITH ANIMALS SOMETIMES MISTAKEN FOR IT

	Tail	Fur	External cheek pouches	Front teeth
Gopher	short, 2 to 3 in., often naked at tip	harsh	always present	large, protruding
Mole	short, 1 to 1% in.	v elvety	none	small
Meadow mouse	short, 1 to 1% in.	harsh	none	small
Kangaroo rat	long, 6 to 10 in.	silk y	always present	small

The mistake most often made is that of confusing the work of the mole with that of the gopher. These two animals, however, are totally different. The mole is not a rodent (gnawer) at all. It lives on animal matter (worms, grubs, and insects) and not vegetable matter. A mole may occasionally be caught in a gopher run; but the gopher

¹ U. S. Dept. Agric., Farmers Bulletin No. 335 (1908), p. 19.

is the real cause of such damage as eating potatoes and cutting off roots, which is sometimes attributed to the mole. The mole crowds along just beneath the surface in loose soil, leaving ridges in which numerous cracks are visible. The gopher digs tunnels, and the sides of these are left clean cut. During dry weather, especially, the mole often burrows deeply and throws up mounds, but these show no trace of an opening, while those of the gopher do. Many moles have been caught for museum specimens by setting Macabee gopher traps carefully in the main runs of moles (see p. 9, Special Sets).

BREEDING HABITS

The data recorded with the 2100 specimens of gophers, collected throughout the state, which are now in the University of California Museum of Vertebrate Zoology, form the main basis for the following breeding notes. Gophers have from three to twelve young in a litter. The smallest number of embryos (unborn young) found in females were three and four, the greatest eleven and twelve, while the average in twenty-eight females from many parts of the state was 5.8. There is evidence to indicate that two litters are frequently raised in a season where food is plentiful, as in alfalfa fields.

Out of eighteen female gophers taken near San Bernardino, November 7 and 8, 1916, four contained small embryos and all but two of the remainder were ready to breed. The breeding season can perhaps best be gauged by the period of growth of the alfilaria, or "filaree." This and malva, among all our native plants, seem to be the gopher's favorite food. The alfilaria is one of the earliest plants to start after the first fall rains, and the resulting nutritious food supply seems to start the gophers breeding. The nest is underground, and usually placed beneath a stump, rock pile, brush pile, or some other such surface protection as will discourage badgers or coyotes from digging. The young remain in it for several weeks after birth and do not leave until they are nearly half grown, when they are able to forage for themselves. In plowing an abandoned field in San Diego County in the middle of January, 1911, the writer uncovered at the bottom of the furrow near a willow stump a nest containing a mother gopher and four hairless, helpless young, barely able to crawl.

The following dates show the approximate time of year when the main crop of young begin leaving the nest, though young may also be found foraging for themselves much earlier or later than these dates: southern California, March 30; San Joaquin and Sacramento

valleys, April 1; Owens Valley, April 15; foothills of Sierra Nevada, April 30; northwest coast region, May 15.

WHEN TO TRAP AND POISON

Obviously, the time to combat gophers most successfully is before the young make their appearance in the spring. Poisoning is very effective, but harder to carry on than trapping in the dry season, especially during August, September, and October, when the supply of green food is scarcest. Trapping is most easily carried on soon after the green vegetation starts in the early winter or spring, for the gophers are then most active. The wise old males which usually cause the trapper the most trouble, seem to lose their instinctive caution during the mating season and often blunder blindly into traps which they would never enter at other times. Every female caught at this time, before the young are born, means the destruction of from four to twelve gophers for the current season.

METHODS OF DESTRUCTION

The five most effective methods of destroying gophers are: (1) poisoning with strychnine; (2) trapping; (3) fumigation with carbon bisulphide; (4) flooding; (5) for permanent relief, encouragement and protection of the gopher's natural enemies, especially the barn owl and gopher snake.

The solution of the gopher problem lies in a combination of two or more of the above methods, rather than in any one of them. Where a large acreage is to be treated, poisoning with strychnine will be found effective in reducing the pest. Traps are safe, can be used at any time, and are effective in the hands of a man who is not afraid to dig and who uses care in setting and in placing his traps. Traps are especially adapted to pasture, where there might be danger of poisoning stock, to gardens, to orchards and to banks of irrigation The use of carbon-bisulphide should be restricted to periods when the ground is wet. Both traps and carbon-bisulphide are good "follow-up" methods in getting the gophers which refuse to take poisoned bait. Land that can be successfully flooded, so as to drown out the gophers, has usually been graded for irrigated crops such as Flooding (irrigation) is therefore automatic, and I have yet to see anyone who was so stupid that he would not hunt and kill gophers which were being drowned out. A man that kills all the gopher snakes and barn owls on his place will have to fight gophers, and deservedly so.

1. POISONING

The four things necessary to poison gophers successfully are: (a) an effective poison such as strychnine; (b) a succulent bait that will be relished by the gopher; (c) bait large enough so that the gopher must eat it at once and not put it in his pocket and carry it away to his storehouse; and (d) placing of the bait in the main run where the gopher can readily find it and not east it out with the dirt, as would often be the case were it placed in an open hole or in a lateral.

In poisoning ground squirrels it has been found that strychnine is more readily absorbed through the membranous cheek pouches, which open inside the mouth, than through the stomach. However, the furlined pockets of the gopher which open outside the mouth do not readily absorb the strychnine. Hence poisoned bait, such as strychnine-coated barley, which is effective on the ground squirrel, is not effective on the gopher. The gopher often puts the poisoned grain in its pockets and carries it away to the storehouse, where the poison soon loses strength.

There are two methods of using strychnine. The first method, which is adapted to treating a large acreage, is given by Mr. de Ong in the second part of this bulletin. This method of placing the bait in the run through a hole made by a probe works well when the soil is damp. However, in cultivated fields when the ground is dry, a second method becomes necessary, as the dry surface soil will run in and promptly fill up the hole made by the probe. In this case it is best to dig down and place the poisoned bait well back in the main run of the gopher. Many times only a few poisoned baits are required. These may be prepared quickly and used as follows:

Carrots, parsnips, sugar beets or sweet potatoes, cut into one-inch cubes and poisoned by inserting a few sulphate of strychnine crystals into a slit made by the point of a knife, are good, especially in the dry season when green food is scarce. Carry the poisoned cubes in an old covered pail marked *Poison*. Find the main run in the same manner as when setting a trap, and with a slender pointed stick, so that you will not have to touch the bait, place one of the poisoned cubes a foot back in each hole, which should then be tightly closed. The hole may be opened forty-eight hours later and if it remains open the gopher may be considered dead.

Poisoned alfalfa has been found effective in orange groves in southern California. The heads of a few tender stalks are bent back and tied with a string so that the tuft is formed at the end. A little strychnine mixed with orange juice is concealed inside the tuft,

which is then pushed well back in the run, and the hole then tightly covered.

2. TRAPPING

Almost any kind of trap will catch gophers sometimes, a few will catch gophers most of the time, but we have yet to see the trap that will catch every gopher every time. There seems to be among experienced farmers throughout the state a decided preference for a gopher trap of the Macabee type (fig. 2a). After a practical test in the field, extending over several years, the "catching average" of this style of trap has been found to equal or surpass that of any other trap that the writer has been able to secure. Its cheapness, compactness, and reliability place it at the head of the list.

Any form of explosive trap, or "gopher-gun," is not recommended because of the degree of danger which attends its use.

WHERE TO SET THE TRAPS

The most effective "set" for the Macabee trap is in the main runway (fig. 1a), and not in the lateral run (fig. 1b) that leads to the surface mound. This necessitates the use of two traps per setting, one in each direction; but the results are so much more certain and quicker that the catch per trap per day is greater than where but one trap is set in a lateral run, where it is often filled full of dirt by A common stiff-handled twelve-inch iron spoon is of the gopher. great assistance in finding the main run and in properly placing the This spoon had better be supplemented by a light shorthandled shovel, for the man that is afraid to dig will never get rid The freshest mound should be selected and the of his gophers. probable direction of the main run determined by noting the angle of the dirt-plugged hole. The mounds are usually situated one or two feet distant from, and nearly at right angles to, the main run.

Now to business: Take the bowl of the iron spoon in your hand and push the other (handle) end of the spoon into the ground where you think the lateral, which leads from the mound to the main run, is. If the spoon strikes an open lateral you will feel the spoon handle drop through the opening. If the lateral is filled loosely with dirt the drop will be less noticeable but still plainly felt. If it is plugged tight you will have to use the shovel to dig down a little distance before probing again. If this fails, try a new mound. When the lateral is found, follow it down to the main run, which is always kept open by the gopher. Use the shovel until you have cleared a place where you can set a trap in each direction. Smooth out the hole with

the spoon but do not disturb more than is necessary. Set the treadle, or pan, so that a slight touch will spring the trap, and place the trap well back within the hole. A little loose dirt should be left in the bottom of the hole, as it will cover the prongs and front end of the trap when the trap is pushed into place. When in place, press the trap down firmly so that it will not slide back if the gopher pushes against it. Then plug the burrow with a clod or a handful of grass or alfalfa and cover completely so that no light can get to the trap. A gopher's instinct prompts him to tightly close all open burrows to keep out his natural enemy, the gopher snake (nature's own gopher

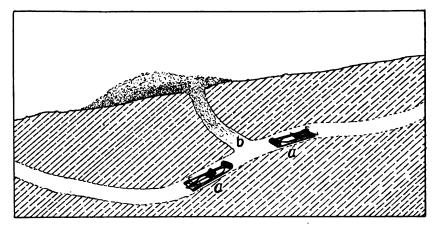


Fig. 1.—a. Best place to set traps or leave poisoned bait, in the main run which is always kept open by the gopher. b. Lateral run, usually partly plugged with dirt, leading to surface mound.

trap). Therefore, if poisoned bait or a trap be placed in an open hole, or the hole be left open, the poisoned bait will often be thrown out, to become a menace to stock, or the trap sprung by the dirt which the gopher pushes ahead of him in plugging the open hole. Set the traps and place the poisoned bait well back in the main runs, which should then be tightly closed.

The trap should have a wire or light chain attached to it and fastened to a chunk of stove-wood or, better still, an old worn-out stewpan which will rattle should you forget and run over the set trap with a harrow or cultivator. Coyotes and house-cats dislike the noise, also, and do not drag the trap so far when they rob it. In case only one trap is available when the main run is found, a careful watch will often, but not always, reveal one or more little flies emerging from the run where it is first opened. These flies seem to have a direct

relation to the gopher, as experiments have shown that the side that they come from is the one occupied at that time by the gopher and hence the place to set the trap. Traps should be visited morning and evening, or oftener.

SPECIAL SETS

Individual gophers will frequently be found that refuse to enter any sort of trap. These gophers are generally old males and are likely to be the ones that do most of the gnawing on fruit trees. When one of these old-timers repeatedly fills the trap with dirt, then special

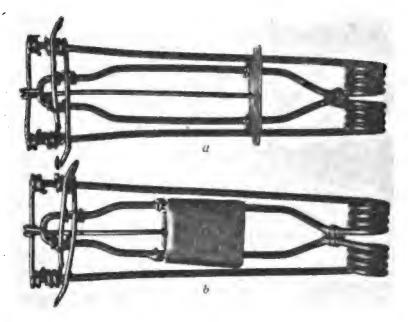


Fig. 2.—a. Regular Macabee gopher trap. b. Reconstructed Macabee trap used to catch "wise" gophers, and moles.

care becomes necessary to catch him. Moles may be captured in this way also. Take a Macabee trap (fig. 2a) and move the treadle forward about an inch and a half, placing the wire which carries the treadle below, instead of above the two longitudinal wires. Cut off the wire trigger to meet this change (fig. 2b). Then bend the treadle backwards at right angles to its former position (fig. 3a) so that it will lie parallel with the trap (fig. 3c), instead of sticking up at right angles and obstructing the runway (as in fig. 3b). Set the trap so it will spring easily. Put a pinch of loose cotton under the treadle to keep the dirt out, and when the trap has been placed in

the run take a stick and cover the whole trap with a thin layer of loose dirt. Another method is to take a recently caught female and rub the reproductive parts on the face of the treadle of the regular Macabee trap. A few drops of urine may be squeezed out during the process, but this only adds to the efficacy of the decoy. If all else fails catch a gopher snake and turn him loose in the run.

After you have put in poison or traps the tops of all the gopher mounds should be kicked off, so that when you make your next round the newly made mounds will tell you where gophers remain and where to put out more poison or traps.

The reconstructed form of the Macabee trap above described will be furnished by the manufacturer if the demand warrants.

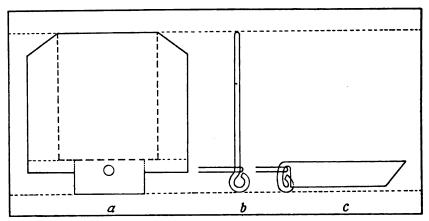


Fig. 3.—a, b. Vertical "treadle" or "pan" of regular trap; heavy dotted lines show places to bend vertical treadle to form horizontal treadle (e).

3. CARBON BISULPHIDE

Carbon bisulphide is volatile as well as inflammable and the gas from it is explosive, so that caution should attend its use. Its use is advisable only when the ground is damp or full of water, as the cracks in dry ground let the gas escape. It does not seem to be as effective on gophers as on ground squirrels, for the gopher burrows are much more extensive and the gopher is therefore harder to reach. It is more valuable as a "follow up" method than for general application.

There are two methods of applying carbon bisulphide. The first is to pour about a tablespoonful on cotton waste, corncobs or other absorbent material, which is then quickly pushed down the hole and the opening promptly and tightly closed. The better way is by the

use of a special apparatus which forces the gas down the hole. This is accomplished by a hand bellows attached to the top of a tank that contains the carbon bisulphide. The air is forced through a pipe from the bellows to the tank, where it passes over the bisulphide and is carried out through a rubber hose which is pushed down the open hole and then tightly surrounded by dirt. Contrivances of this sort, such as the Eureka Squirrel Exterminator, are on the market.

4. FLOODING

As has been pointed out above, flooding of fields often is an essential part of agriculture in irrigated sections. The main point, then, is to see to it that the gophers which are drowned out and seek the higher borders, are promptly dispatched. A good dog will do this effectively until he gets tired, and then the farmer must be ready to give the gophers proper attention with the back of a shovel.

5. ENCOURAGEMENT OF THE GOPHER'S NATURAL ENEMIES

Comparatively few ranchers realize the true value of barn owls and gopher snakes as allies in their war on gophers. A pair of nesting barn owls were found by the writer to catch from three to six gophers a day for their young. No one who has ever counted the number of rodents brought in by a pair of these owls during a single season would ever doubt their value as gopher destroyers.

On May 13, 1914, near Mendota, Fresno County, California, Mr. John G. Tyler² found two pairs of barn owls nesting in an old tank house. "One nest was placed in the tank on the bones, fur, pellets, and refuse that had accumulated to a depth of several inches. bird was perched on a beam overhead asleep, while his mate occupied the nest, which contained four very small birds and six eggs. tered about on the floor were five pocket gophers (Thomomys), five kangaroo rats (Perodipus), one pocket mouse (Perognathus), and two white-footed mice (Peromyscus), all of which were in good condition and undoubtedly of the previous night's capture. Besides these, there were partly eaten remains and fresh skeletons of several more. ... If the thoughtless persons who so relentlessly destroy this owl on account of its supposed fondness for chickens and pigeons would take the trouble to keep watch of a nest-site through one season, the most ignorant among them could hardly fail to realize that they are working against their own best interests whenever they kill a barn owl."

² Condor, XVII, January, 1915, p. 57.

The gopher or bull snake may steal eggs occasionally, but his main diet consists of small rodents, chiefly gophers. A wise man will therefore protect the gopher snakes on his premises. Every gopher that the barn owl or gopher snake destroys means one less for you to catch.

OTHER METHODS OF CONTROL

Some other methods of controlling pocket gophers are: (1) protecting trees with wire netting; (2) planting gopher repellant plants; (3) using rodent virus; (4) surrounding small plot by a trench; (5) protecting of ditches by cement.

1. PROTECTING TREES WITH WIRE NETTING

One-inch mesh galvanized wire netting in the form of a cylinder one foot in diameter and eighteen inches high may be placed about young trees when they are planted, to protect them from the attacks of gophers. The top of the netting should be put just below the surface of the ground, and the trunk of the tree above ground protected in some other way so as not to interfere with cultivation, which the netting will certainly do if it sticks above ground.

2, 3. GOPHER REPELLANT PLANTS; RODENT VIRUS

Plants which will drive gophers away, and a virus of a "gopher infectious" disease, have both been much exploited, but neither remedy seems to have "made good," and cannot therefore be recommended.

4. SURROUNDING SMALL PLOT BY A TRENCH

Small plots of ground have been protected by being entirely surrounded by a trench eighteen inches wide and two feet deep, with open five-gallon cans buried flush with the bottom in the ditch at twenty-five foot intervals, to catch and hold the gophers which tumble into the ditch, and thence into the cans.

5. PROTECTION OF DITCHES BY CEMENT

A power company which had much trouble with gophers in a large ditch dug a four-inch trench six feet deep straight down through the middle of the lower bank of the ditch. The dirt was loosened with an iron bar and removed with a narrow shovel, of the type used in digging telephone-pole holes. The trench was then filled with a "lean" mixture of cement and sand, which was carried on a barge that floated on the water in the ditch. The cement was conveyed to the bottom

of the trench by a galvanized iron chute which was built in sections so as to be readily adapted to any depth. This method was said to have been expensive, but satisfactory in the long run.

A small irrigation ditch having a seven-foot "surface" has been protected from gophers, weeds and leakage by applying to the sides and bottom, first a $\frac{7}{8}$ -inch coat of 7 to 1 cement and then a surface layer $\frac{1}{4}$ inch thick of 3 to 1 cement. This proved satisfactory.

All of these preventatives are costly and are advisable only in those situations where protection against gophers cannot be obtained by their destruction.

II. A METHOD OF POISONING POCKET GOPHERS

By E. RALPH DE ONG

Agricultural Experiment Station, University of California

One of the most satisfactory, and at the same time, one of the cheapest methods of controlling pocket gophers is through the use of poisoned baits, such as chopped vegetables, dried prunes, or raisins. The formula³ which has proved very successful at the University Farm is as follows:

Sweet potatoes, parsnips, or carrots8	quarts
Flour paste	4 pint
Strychnine alkaloid, powdered4	ounce
Saccharine	ounce

Chop the vegetables, or cut them with a knife, into one-half inch cubes. Make a thin paste of flour and water and boil for a few min-

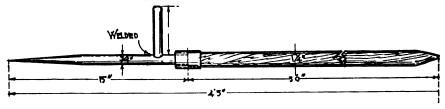


Fig. 4.—Tool for probing ground so as to locate underground burrows of pocket gophers.

utes. Stir the strychnine and saccharine into one-half pint of the cooked paste and pour it over the chopped vegetables, stirring until each piece is coated. Two or three or these cubes are to be dropped in each runway. The alkaloid form of strychnine should be used in preference to the sulphate, as the former is but slightly soluble in water and remains largely on the outside of the bait, leaving the center sweet. The saccharine is used to disguise partially the bitterness of the strychnine.

To locate the underground burrows, the method previously recommended will prove satisfactory, or a simple tool may be used, which can be made at any blacksmith shop. This is a shank of steel, threequarters of an inch in diameter and about fifteen inches long, pointed

³ U. S. Dept. Agric., Farmers Bulletin No. 484, p. 39.

at the lower end. This is fitted into a wooden or iron handle, three feet long, one end tapered slightly, to be used in enlarging the openings made into the runway. To aid in sinking the probe into the ground, a foot-piece should be welded on to one side of the steel rod (fig. 4). To use this tool it is necessary for the ground to be wet down to the ordinary depth at which the gophers are working, usually from three to eight inches below the surface. Sink the probe into the ground, ten or fifteen inches from the gopher hill, continuing the work until the burrow is located, which will be recognized by a sudden dropping of the probe. If necessary, enlarge the opening into the runway with the blunt end of the handle, then drop in the bait, and close the hole with the foot. The operator will soon become expert in locating the runways so that, where gophers are abundant, one man may bait hundreds of runs in a single day. One piece, of seven acres of heavily infested alfalfa land, has been covered by one man in a day and a half.

Poisoning is more successful from late summer, after green food has become scarce, until grass starts in the fall or winter, depending on rainfall and temperature. It should be delayed until the top layer of ground is thoroughly wet, not only to facilitate operations, but because, after the heavy rains begin, gophers have a tendency to migrate into fence rows or the uncultivated strip along driveways, which greatly reduces the amount of ground necessary to cover. One thorough application in such places should kill 90 per cent or more of the gophers. After another rain the ground can be gone over again and any fresh hills poisoned. Alfalfa is not as successfully treated as orchard or bare land, on account of the abundance of succulent food.

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ARBOR DAY

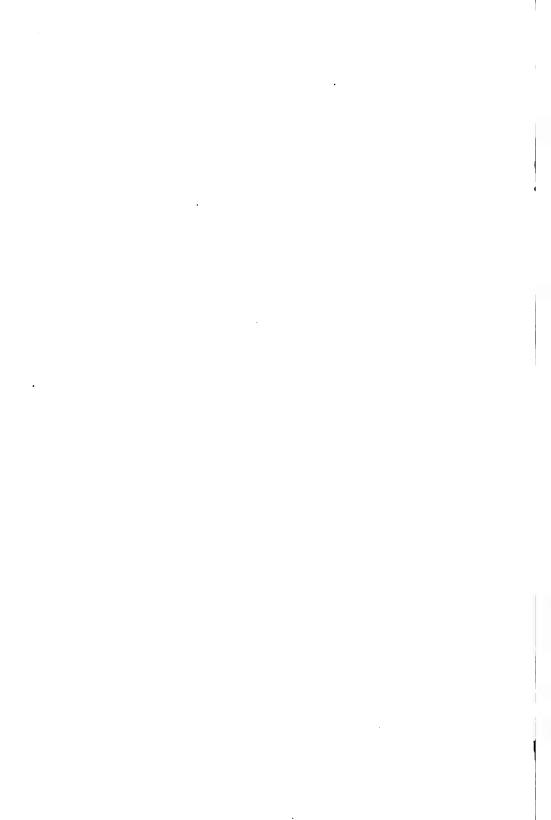
A number of inquiries have come to the Monterey Tree Growing Club asking for the date of Arbor Day. A majority of the states have fixed an official date, most of them in May, but for one reason or another different dates are selected in different communities now, to celebrate "Tree Day". The Federation of Tree Growing Clubs of America has accumulated considerable data upon this tree planting subject, and has arrived at conclusions which upset the customary ways of celebrating the day. It urges that every town in the world ought to have a tree planting day celebration of some kind.

It knows, however, that the custom of celebrating Arbor Day is gradually dying out, due to the impracticable plans and methods employed by the good people who unwittingly have destroyed its popularity. Large sums of money, in the aggregate, have been wasted in many communities in attempting the impossible successful planting of trees without expert suner-

served; accordingly the Federation advises a movement to induce every county board of supervisors to select some day in the year which will best suit local conditions and not interfere with school work.

"Planting Memorial Trees" suggests the plan of the tree organization for celebrating Arbor Day, which has been adopted by the Grand Parlor of the Native Sons of the Golden It is not difficult to think of many events and the names of many individuals worthy of being honored by a "living monument". In selecting a person, or persons, to be honored it is recommended that some local party, living or dead, who has done some worthy service for the advancement or physical betterment of the community.

To place beside the memorial trees there should be provided for each one a permanent monument, to bear an inscription giving the name, the service performed and the date of planting. The use of a large



FG. Layo TE

SIXTH BIENNIAL REPORTING

OF THE

STATE FORESTER

OF THE

STATE OF CALIFORNIA



CALIFORNIA STATE PRINTING OFFICE SACRAMENTO 1916

CALIFORNIA STATE BOARD OF FORESTRY.

HIRAM W. JOHNSON	Governor
Frank C. Jordan	Secretary of State
U. S. Webb	Attorney General
G. Morris Homans	State Forester
OFFICE OF STATE FORESTER.	
G. Morris Homans	State Forester
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WALTER J. MOODEY	Secretary
J. A. HABNEY	Clerk

LETTER OF TRANSMITTAL.

STATE FORESTER'S OFFICE,

SACRAMENTO, CALIFORNIA, December 5, 1916.

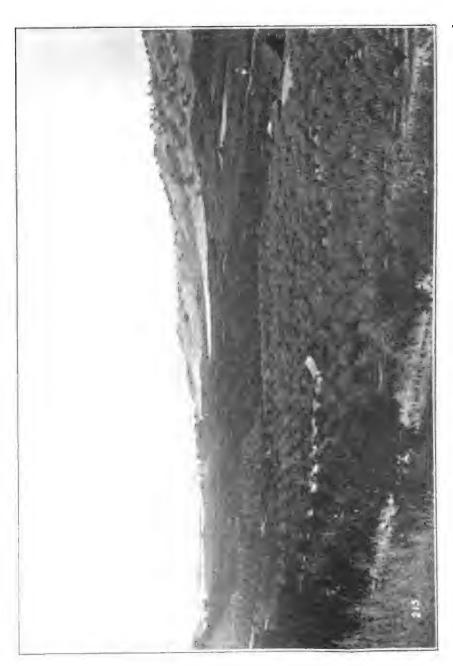
His Excellency, HIRAM W. JOHNSON,

Governor of California.

Siz: I have the honor to present herewith a report entitled, "Sixth Biennial Report of the State Forester of the State of California."

Very respectfully,

G. M. HOMANS, State Forester.



Throughout the state ranchers depend upon the grass covered hills for grazing their stock. Many thousands of acres of grazing land on such hills us these are burned over abbundly, and, in some cases, stockmen have been forced to go out of business because of the destruction of their natural forage. This is not forcat destruction, but deserves equal state protection,

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FORESTRY.

INTRODUCTION.

The great importance of the forest resources of California is unquestioned. Within the State are located many of the finest forest areas of the world, and the forests stand as a silent index to the unlimited opportunity which California has to be a leader in forest industries and to remain indefinitely the exquisite playground that she is today.

Value warrants its own protection. We protect our cities, our rivers, our transportation lines, our homes and practically all that is dear and of value to us. Unfortunately, as a state, we have done little to protect our forest areas. We seem to lose sight of the fact that the forests bear a vital relation to almost every industry, either directly or indirectly. The value of California's timber lands places an economic obligation on our hands. We are not doing the work of protecting them as we should. However, in this report is outlined what is done under the legislative limitations now existing.

It is well to stop and think of the vast amount of work to be done in California by the Forestry Department. We have no state forest reserves; have no state forest nurseries; no definite provision for controlling the numerous fires which annually destroy thousands of dollars worth of property and many human lives, threatening far more; and no adequate appropriation to meet the many demands made under the present forest law.

A marked activity in recent city and highway tree planting is indicative of a wide field of work for the Forestry Department along esthetic lines, and a good deal has been done and is being carried on to promote shade tree planting throughout the state.

The State Forester depends for his data upon the federal forest officials, and the voluntary firewardens who report fires outside the national forests. Care is exercised to prevent duplicate reports being taken, and, in compiling the tables, duplicates, when discovered, have been destroyed. The voluntary firewardens receive no compensation, and some fail to report fires altogether. Consequently, it is impossible under the present system to obtain reports of all fires outside the federal reserves.

During the summer months repeated calls were made upon the State Forester for assistance in bringing fires under control. Response was made to such calls in as many cases as possible. A representative of the state has been on many of the large fires, and the expense thus incurred paid from the general maintenance fund, an appropriation designed to meet other needful expenditures. Consequently, what has been done in lending assistance in fighting fires was accomplished at the expense of other departments of the work.

The educational phase of work is important; lectures on forestry subjects are given from time to time before schools and clubs throughout the state. Special attention is given to localities in which the people are ready and willing to organize protective associations for mutual benefit. The State Forester stands ready to give suggestions and other assistance to any community desirous of organizing such an association. Again feeling the limitations of inadequate appropriation, this cooperation can not be as efficient as it should be.

There is undoubtedly much to be done by California in protecting her forests and streams, and it can not be accomplished without unselfish, farsighted and popular legislation. Every effort has been made to achieve as much as possible under the laws now operative.

FIRE REPORT-1915-1916.

The usual report on forest fires applies to the last two years with the exception that the more adequate supervision on the national forest reserves has diminished the losses thereon quite materially. In the summer months of 1915 a money loss amounting to \$246,902.77 was sustained; this is not at all above the average, and one is forced to regret that an appropriation equivalent to one-half of this amount at least is not available to be spent biennially toward preventing the With the present small appropriation the California State Forestry Department can not carry on any extensive forest protection The present annual appropriation for the department is \$22,900. In some cases the federal authorities have spent more than this in the work of controlling a single serious forest fire. The law now in vogue does not permit the State Forester to hire fighters except in cases of extreme emergency, when through special permission of the State Board of Control, he may pay fire fighting bills in limited amounts. No adequate protective system can be operated in this way.

Nevertheless, everything possible is done to use the appropriation wisely so far as it can be applied to the fire situation. During 1915 this office conducted 40 investigations of fires occurring outside the national forests, and 74 during the season of 1916. A representative from the department assisted in fighting nine large fires in 1915, and ten in 1916. The firewardens acting under the direction of the State Forester have done excellent and generous voluntary work in bringing hundreds of fires under control. These men justly deserve compensation for their work, and many take the attitude that they can not afford to leave their private interests to endanger their lives fighting fires for no pay at all.

The 114 fire investigations made during the past two seasons have made necessary a total mileage of 6,215 miles. This has been made by railroad, motorcycle, horseback, and automobile transportation. Two automobiles were purchased in the spring of 1916, and they greatly facilitate both the fire investigations and the routine work of the

department.

Wherever we have made investigations of fires, the sentiment throughout the community has been one in favor of a thoroughly adequate system of forest protection. The rural residents are willing and eager to cooperate with such a system, but they alone can not perfect any widespread protective force. Since the investigations were made in practically every part of the state subject to forest fires, we have in this expression a fair index to the popular realization of the importance of a much needed development in the work of fire protection.

These 114 fire cases represent a total money loss of \$303,058, being the destruction of timber, forage, grain, stock and buildings and fences. Several human lives have been lost, and who can estimate such unneces-

sarv toll!

The state of California must have an adequate system of paid summer patrolmen who can work in splendid cooperation with the federal forest service. We must have a clearly-defined law making it possible for the State Forester to render actual assistance in time of need. We must perfect a prevention system and then supplement it with a strong provision for suppression.

FIRE REPORT FOR 1914.

Table Showing Area Burned Over. Number of Fires.

		—			
Location	Timber	Brush	Grass	Total	Number of fires
Inside National forests Outside National forests	11,299.48 9,535	42,463.57 45,337	55,783	53,763.05 110,655	1,468 351
Totals	20,834.48	87,800.57	55,783	164,418.05	1,819

Table Showing Money Loss by Forest Fires in 1914.

		•	
Location	Timber and range	Improvements	Totals
Inside National forestsOutside National forests	\$ 67,730 6 7	\$91,999 25	\$160,658 73 159,729 92
Totals	\$67,730 67	\$91,999 25	\$320,388 6 5

FIRE REPORT FOR 1915.

Table Showing Area Burned Over. Number of Fires.

_		Number			
Location	Timber	Brush	Grass	Total	of fires
Inside National forests Outside National forests	12,766 24,631	28,644 141,960	477,447	41,410 644,038	1,527 434
Totals	37,397	170,604	477,447	685,448	1,961

Table Showing Money Loss by Forest Fires in 1915.

		Amount of damage	
Location	Timber and	Improvements	Totals
Inside National forestsOutside National forests	\$140,209 50	\$80,635 00	\$26,058 27 220,844 50
Totals	\$140,209 50	\$80,635 00	\$246,902 77

FIRE REPORT FOR 1916 (Incomplete).

Table Showing Area Burned Over. Number of Fires.

		Area burned	l over, acres		
Location			_		Number of fires
	Timber	Brush	Grass	Total	
Inside National forests	. 			81,573.59	1,296
Outside National forests	6,917	146,308	162,409	315,634	148
Totals	6,917	146,308	162,409	397,207.59	1,444

Table Showing Money Loss by Forest Fires in 1916 (incomplete).

	Amount of damage					
Location	Timber and range	Improvements	Totals			
Inside National Forests			\$15,338 85			
Outside National forests	\$225,924 00	\$27,035 00	252,959 00			
Totals	\$225,924 00	\$27,035 00	\$268,297 85			

AGGREGATE FIRE REPORT FOR 1914, 1915, 1916. Table Showing Area Burned Over. Number of Fires.

		Number			
Location	Timber	Brush	Grass	Total	of fires
Inside National forests Outside National forests	24,065.48 41,083	71,107.57 333,605	695,639	176,746.64 1,070,327	4,291 933
Totals	65,148.48	404,712.57	695,689	1,247,078.64	5,224

Table Showing Money Loss by Forest Fires in 1914, 1915, 1916.

	Amount of damage					
Location	Timber and range	Improvements	Totals			
Inside National forestsOutside National forests	\$483,864 17	\$199, 669 25	\$202,055 85 633,533 42			
Totals	\$433,864 17	\$199,669 25	\$835,589 27			

Table Showing Number of Fires by Causes in 1915.

Location	Railroads	Lightning	Incendiary	Brush burning	Самрен	Lumbering	Unknown	Miscellansous	Totals
Inside National forests Outside National forests	25 22	310 22	801 44	75 37	895 51	71	278 176	77 82	1,527 434
Totals	47	332	345	112	446	71	449	159	1,961

Fire Data for 1915 (Outside National Forests).

Country	Num- ber of		Area burne	d over, acr	···	Money damage			
County	fires	Timber	Brush	Grass	Total	Timber and range	Improve- ments	Total	
Alameda	14		2,580	1,492	4,022	\$3,000 00		\$3,000 00	
Butte	8	162	4,268	900	5,380	80 00	\$ 515 00	596-00	
Oalaveras	12		1,640	5,140	6,780	550 00	1,800 00	2,350 00	
Contra Costa	3		1,000	2	1,002				
Del Norte	1		800	,	300				
El Dorado	9		680	741	1,421	٠	I		
Fresno	29	1,000	29,080	160,358	190,488	15,501 00	2,3 55 0 0	17,856 00	
Glenn	2		10	350	360	25 00	500 00	525 00	
Humboldt	6	161	2,083	1	2,245	, 57 00		57 00	
Inyo	' 1	5	5	10	20	L			
Kern	27		5,76 5	257,065	262,850	408 00	660 00	1,008 00	
Lake	1			2	. 2	10 00		10 00	
Lassen	17	5,598	l	1	5,594	500 00		500 00	
Los Angeles	20		8,841	9	8,850	4,200 00		4,200 00	
Madera	2			900	900	4,000 00		4,000 00	
Marin	14	4	76	. 335	415	235 00		235 00	
Mariposa	2	. 80	. 2	1	23	l'	50,000 00	50,000 00	
Mendocino	17	5.148	29,101	841	84,590	5,157 00		5,157 00	
Merced		5,500		5,500	11,000		9,600 00	52,830 00	
Modoc	2		140	l	140	70 00	1	70 00	
Monterey	9	350	2.135	3.890	5,875			900 00	
Napa		l	20	688	708	880 00		390 00	
Nevada	_	1	425	325	751			385 00	
Orange	. 8	ī	1	2	4				
Placer	_	248	_	4,096	4,703	8,300 00	2.000 00	5,300 00	
Plumas	5	61		2,550	73	500 00	1 3000 00	500 00	
Riverside			972	302	1,274	10 00		10 00	
San Benito	1 -			505	20	20 00	***********	10 00	
San Bernardino			19.569	306	19.875	,	600 00	600 00	
San Diego		12	7,574	355	7,941	2.840 00	1,490 00	2.890 00	
San Joaquin			1 .,0.2	8,228	3,223	. 24020 00	100 00	100 00	
San Luis Obispo			1,050	500	1,550	10 00	100 00	10 00	
San Mateo	16	61	141	285	487	250 00		250 00	
Santa Barbara			1,105	206	1,311	2000		200 00	
Sacramento			1,100	25	25	 			
Santa Clara			8	41	49	25 00		25 00	
Santa Cruz	15	76	974	40	1,090	920 00	100 00	1.020 00	
		5.032			5.252			5.150 00	
Shasta		-,	110	110	26	2,650 00	2,500 00	,	
Sierra		15		0.000		1,500 00	#E 00	1,500 00	
Siskiyou	26 15	86		9,380	15,856	1,082 00	475 00	1,567 00	
		802	2,266	811	3,879	44,160 00		44,160 00	
Sutter				44	44				
Tehama	' 7	260	3,570	2,610	6,440	775 00	50 00	825 00	
Trinity		20	200		220	80 00		30 00	
Tulare		, 8			7,098	1,429 50	700 00	2,199 50	
Tuolumne			1,500		2,800	1,000 00	200 00	1,200 00	
Ventura			12,676	7,061	19,727	50 00	7,000 00	7,050 00	
Yuba	1			8,000	8,000	1,500 00		1,500 00	
Totals	434	24,631	141,960	477,447	644,038	\$140,209 50	\$90,685 00	\$290,844 50	

PROTECTIVE ASSOCIATIONS.

There are six forest protective associations in California, and there should be a great many more. The communities represented regard the efforts made most favorably, and urge that other rural districts follow their example. The State Forester is glad to give any help possible in forming such protective organizations where the residents of a vicinity frequented by forest fires desire to do what they can to prevent and protect themselves from fires.

The following reports are made by four of the associations.

PLACER FOREST AND HOME PROTECTIVE ASSOCIATION.

Headquarters at Applegate, California.

- 1. The territory represented in the association is five square miles.
- 2. This acreage is assessed equally and patrolled by voluntary patrols.
- 3. In the last biennial period the total expenditures have been \$500, most of the labor and material used having been voluntarily contributed.
- 4. During the current season five fires are reported, three of which were serious ones.
- 5. About 250 acres of merchantable timber were burned over, injuring one million board feet and destroying beyond salvage 750,000 board feet of timber.
- 6. A loss of \$2,500 is represented in the destruction of improved property.
 - 7. No arrests have been made under the fire laws.
- 8. Members of the association consider the fire hazard worse during the current season than since the organization started in 1913.
 - 9. We have learned the following lessons by experience:

Don't backfire unless a sufficient number of patrolmen can be assigned to the work of guarding the trail.

In backfiring special attention should be given to guarding the hillsides above the fire trail.

If possible, delay backfiring until night.

Patrol backfire trail for at least twenty-four hours.

For this community the best equipment is a short-handled, flat shovel and an axe.

One chief should have full control in fire-fighting.

W. D. READ, Secretary.

REDWOOD FIRE PROTECTIVE ASSOCIATION.

Headquarters at Fort Bragg, California.

- 1. The association includes the Ten Mile and Noyo River watersheds in Mendocino County, representing a patrolled area of about 100,000 acres, of which about 77,000 acres are assessed for the purpose of protection.
- 2. Two regular patrolmen are employed by the association and four extra men are employed during the dangerous fire season.
- 3. During the season a total of about \$1,200 has been expended by the association in addition to \$250 which was contributed by private individuals for protective work.
- 4. Two fires were fought and brought under control with no damage done. We have had no bad fires. R. D. Swales, Secretary.



Thousands of acres of foothill land in California are being opened up by ranchers. Much of the land has young timber which if adequately protected, will become merchantable. Under the present lack of state protection, vast areas of this type of country are burned over annually.

STOCKMEN'S PROTECTIVE ASSOCIATION.

Headquarters at Livermore, California.

- 1. An area of 250,000 acres is protected by our association. This territory is patrolled by a cooperative agreement between the association and the counties of Alameda and San Joaquin. All but 5,000 acres of government land are assessed. No patrolmen are employed by the association, but it nominates the patrolmen who are subsequently appointed by the counties.
- 2. Extra men are employed only in case of fire. So far the number of extra men varies from six to two hundred and fifty.
- 3. During the last ten years the association has expended for protection, telephone lines and other protective work, approximately \$5,000. In addition to this many hundreds of dollars have been spent for protection by individual members.
- 4. About five hundred fires have been extinguished by the association during the last ten years. Not more than a dozen were able to do much damage, and in recent years the fires have been reduced to a minimum.
 - 5. One life has been lost.
- 6. About \$20,000 has been lost through fire damage to houses, barns and other improved property since the organization started its work.
- 7. We have made no arrests, but have collected \$40,000 in insurance and fire losses through influential committees.
- 8. We do not need the application of the Week's Law in this district. Sufficient assistance is given by state, county and federal authorities and insurance companies, together with public opinion and the local press, to give us ample protection. We are following out a plan on these lines: An organization including large and small landowners alike, with a nominal membership fee. We have sufficient fire-fighting equipment to insure protection. The use of mountain telephone lines and automobiles partly owned by private individuals and corporations has been invaluable in attaining adequate protection.

We recommend cooperation with the Fish and Game Association, reputable gun clubs, and the fish and game officers of the state and counties. We approve of cooperation between local fire-fighting associations, the boards of supervisors of counties and the State Forester, making the office of the State Forester a central bureau.

John J. Callaghan, Secretary.

TAMALPAIS FIRE ASSOCIATION.

Headquarters at Mill Valley, California.

- 1. The total area protected by the association is 40,000 acres.
- 2. There have been thirty-nine fires on the protected area during the past three years, divided by causes as follows:

Incendiarism	1
Coals from old fires	1
Boys' firecrackers	1
Boys' matches	
_ *	1
Burning matches	5
Burning tobacco	6
Burning brush	3
Burning rubbish	_
Sparks from locomotive, or mountain railway, or burning matches, or	~
tobacco thrown from cars	10
No cause determined	7
	_
:	39

- 3. The average area burned over per year was 216 acres.
- 4. Deducting the expenses for fire-fighting (\$1,303.11) and those expenses belonging to the year 1914-1915 (\$770.30), the total amount expended in 1915-1916 is \$4,466.75.
- 5. In the spring of 1916 the following new fire trails were constructed: West Point to Muir Woods, Sugarloaf Ridge, Mesa to Lovell avenue, Larkspur Cut-off, Bolinas Ridge south. These trails have a total length of 18,864 feet and vary in width from 12 to 20 feet.

The following fire trails were cleaned out: Ross Ridge, West Peak to Lagunitas Creek, West Peak to Rock Spring, Kent Ridge, King Mountain Ridge, Larkspur Hogback, Corte Madera Ridge, Blythedale Ridge, Bolinas Ridge north, Army Ridge (Baltimore Canyon); a total length of 34,002 feet.

The three years work has resulted in the building of approximately twenty-seven miles of new fire trails.

There can never be too many fire trails in the Tamalpais region and the work done by this association should be considered merely as the start of a very large task, which it will take many years to complete. Fire trails should be located not only on the tops of all of the principal ridges, but also half way down their slopes. Narrow trails, in many instances, are just as efficient as broad ones and are vastly cheaper to build and keep clean. Unless a large sum of money should become available it should be the policy hereafter to construct as great a mileage as possible of trails from five to ten feet wide.

6. As heretofore, the association has lacked funds for the construction of telephone lines, nor have the various legal and technical difficulties relating to connections with other lines and stations been solved. A line from West Point to Rock Spring and Ridgecrest (on Bolinas Ridge) is extremely important, and this line should eventually be extended north along Bolinas to Olema. Telephone stations are badly needed at Lone

Tree, Pipe Line Bridge, and on the crests of Blythedale and Corte Madera ridges. A station somewhere in the Big Carson country would also be useful.

7. The supply of fire-fighting tools has not been added to during the past year except that new boxes have been placed at Kentfield and Lagunitas. Those tools lost, broken or stolen have been replaced. It is interesting to note that the loss from theft or vandalism has been almost negligible.

In round numbers the association now owns shovels, axes, brush hooks, lanterns and water bags in such quantities as to fully equip a force of

500 men.

8. The organized forces in the various towns have remained the same as during the past two years. Many severe tests have proved their

leaders to be thoroughly efficient.

William C. Hodge has held the position of assistant forester at Mill Valley and two regular patrolmen have been on duty all summer—A. O. Roseveare at Bootjack Camp, and Grover Trimmer at the Lagunitas Gun Club. As in the past, the patrolmen have controlled the building of camp fires by a system of written permits allowing the use of fire in designated spots only. This system has proved thoroughly satisfactory and not a single fire has started in three years as a result of carelessness with camp fires. No complaint has been made against the permit system.

Needless to say, the fire-fighting organizations located in the various towns from Mill Valley to Lagunitas should become permanent institutions, for they are the backbone of the whole system. Their leaders and agents should receive a small compensation in the nature of a retainer during the season of fire danger; and the fire-fighters under organization should be paid for their services by the county, as they are at present.

There should always be a forester in charge of the organization as a whole. Two patrolmen are sadly inadequate for the work in hand and their number should be increased to at least six. The plan of putting extra patrolmen on duty Sundays and holidays has worked out well and should be continued.

Under any circumstances it would be well to take steps leading to the formation of a forest, brush and grass fire district to include certain lands in the southern part of Marin County. This would necessitate action by the state legislature. If a fire district could be formed somewhat along the lines of the present mosquito district the financial aspect of fire prevention would be greatly simplified and the burden of supporting the work would be evenly and lightly distributed where it belongs—within the district which wants and receives the benefits of protection against forest, brush and grass fires.

F. E. OLMSTED, Forester.

FOREST PROTECTION BY LUMBER COMPANIES OUTSIDE OF PROTECTIVE ASSOCIATIONS.

Although several lumber companies are active more or less in fire protection and prevention work in their affiliation with certain forest protective associations, sight should not be lost of the companies who

are working out their individual protection problems.

Data relative to the general condition of the various cutover holdings in the state was published after thorough investigation in the fourth and fifth biennial reports of the State Forester. In many cases it was then necessary to report unfavorable fire conditions, many of which, unfortunately, still remain unchanged. Certain companies have for several years maintained careful watch over their cutover lands, and have done much toward preventing fires; also generously assisting in bringing fires on their own property and those burning on adjacent areas under control.



Piles of slash ready for burning on Red River Lumber Company's property in Lassen County.

Investigation shows that slash and debris resulting from logging on the property of the Red River Lumber Company is being piled and burned. Disposal by this method is more economical than any other under conditions existing. Full utilization is being made of raw material, and the company offers a generous attitude toward any genuinely profitable and economic change of methods.

Information received from F. E. Olmsted, formerly district forester of District Five, including all the national forests in California, indicates that "during the past summer the Diamond Match Company has cooperated with the United States forest service in protecting about 30,000 acres of its lands against fire. The district concerned lies in the Butte Creek region, and includes those lands now being logged. This cooperation was entered into largely as an experiment. The company



The lumber industry in California can without question be permanently one of the greatest sources of revenue to the state if the cut over lands can be properly managed and reproduction protected.

also has two patrolmen of its own on duty who guarded the remainder of its holdings. No fires of any consequence occurred. The Diamond Match Company has also begun to apply the principles of forestry to its logging operations. It aims to obtain the closest possible utilization in stumps and tops; to lessen the loss from breakage; to leave no merchantable material on the ground; and its consulting forester marks suitable trees which are left standing for seeding purposes (both pine and fir). After the first rains in the fall the slashings are burned in accordance with a method which might be termed 'burning in patches under control.' The brush is not piled, but trails are cut around groups of reproduction so that young growth left standing is carefully preserved. These measures are purely experimental. The company wishes to prove them successful and economical.'

A few other companies are working individually to prevent and suppress fires on their lands. Where cooperation with the United States forest service and the State Forester is possible companies should take advantage of it. Other states have enacted rather stringent forest laws, but if the lumbermen will voluntarily impose fire prevention measures and incorporate them in their operations, it may avoid the necessity in California of a law such as Oregon has in force, requiring owners of timber lands to patrol their holdings. The act is printed here in full since, although severe, it has been well accepted and enforced in Oregon.

(H. B. 371.)

CHAPTER 247.

AN ACT

To require owners of timber lands to provide a fire patrol therefor. Be it enacted by the people of the state of Oregon:

SECTION 1. Every owner of timber land in the state of Oregon shall furnish or provide a sufficient fire patrol therefor, during the season of the year when there is danger of forest fires, which patrol shall meet with the approval of the State Board of Forestry.

- SEC. 2. In case any owner or owners shall fail or neglect to provide such fire patrol, then the State Forester, under direction from the State Board of Forestry, shall provide the same at a cost not to exceed five (5) cents per acre per annum. Any amounts so paid or contracted to be paid by the State Forester, shall be a lien upon the property, and shall be reported by the State Forester to the county court of the county in which such lands are situated, and shall by such court be levied and collected with the next taxes on such lands in the same manner as taxes are collected. Said county court shall instruct the proper officer to extend the amounts on the assessment roll in a separate column, and the procedure provided by law for the collection of taxes and delinquent taxes shall be applicable thereto, and upon collection thereof, the county court shall repay the same to the State Forester to be applied to the expenses incurred in carrying out the provisions of this act.
- SEC. 3. For the purposes of this act, any land shall be considered timber land which has enough timber standing or down, to constitute, in the judgment of the State Board of Forestry, a fire menace to itself or adjoining lands.
- SEC. 4. The owner of any land coming under the provisions of this act, who shall reside within one and one-half miles of said land, shall be considered, by virtue of said residence, to maintain a sufficient fire patrol, and shall not be compelled to maintain additional patrol on such land.
- SEC. 5. For the purposes of this act, an adequate fire patrol shall be construed to mean one equal to that maintained by 50 per cent of timber owners in the same locality, or under similar conditions in other localities, who are in good faith patrolling the interpretation of the same in good faith patrolling the interpretation.

Filed i he Secretary of State February 26, 1913.

COOPERATION WITH STATE DEPARTMENTS.

Purchase of Timber and Land on Tahoe Wagon Road.

Perhaps no thoroughfare in the state is more noted for its scenic attractions than the stretch of road winding through the Sierras from Placerville to Lake Tahoe. This beautiful highway passes for miles through splendid forests, and follows the rugged canyon of the American River. Much of the timber land traversed is privately owned, and those in control have been cutting some of the timber until the fear arose that the logging would greatly detract from the natural attraction of the road.

The women of the Shakespeare Club of Placerville became thoroughly interested and were instrumental in having a bill passed providing for the purchase by the state of a strip of land not to exceed 300 feet on both sides of the road, and for the timber thereon. The bill placed the work in the hands of the State Engineer, who later requested cooperation from the State Forester. Subsequently the Forestry Department made a careful investigation and survey of the property, and submitted a final report recommending certain areas for purchase. The department also made a map of the property to be purchased, and an accurate cruise of the timber standing on the respective strips. Fair figures of price for both land and timber were also given in the report. The property owners were most helpful in their willingness to appreciate the admirable purpose of the bill and to agree to reasonable terms of purchase.

CHAPTER 762.

An act to make an appropriation for the purpose of purchasing additional rights of way, land and trees on and along the course of the Lake Tahoe wagon road.

[Approved June 12, 1915. In effect August 11, 1915.]

The people of the state of California do enact as follows:

SECTION 1. There is hereby appropriated, out of any money in the state treasury not otherwise appropriated, the sum of seven thousand dollars for the purpose of purchasing additional rights of way, lands and trees on and along the course of the Lake Tahoe wagon road, a state highway, and within a maximum distance of three hundred feet on each side of the center thereof, as shall be selected and designated by the department of engineering.

SEC. 2. The department of engineering shall have full control and supervision of purchases or said additional rights of way, land and trees.

SEC. 3. The state controller is hereby instructed and directed to draw his warrants at such times and in such amounts as the department of engineering may present claims for; said warrants shall be drawn in favor of the said department of engineering, and the state treasurer is hereby directed and instructed to pay said warrants and the department of engineering shall distribute the same.

Timber Cruise for the State Surveyor General.

With relation to the status of 1,900 acres of land in El Dorado County, the State Surveyor General requested the State Forester to determine the actual amount of timber having been cut from the area. Suit was pending in which this technical information would be of great value.



A curve in the road. This property now belongs to the state, and the trees are no longer in danger of being cut for commercial use. The road as shown here winds for miles through giant firs and pines.

The area was resurveyed and a specially accurate topographic map made of it by an employee of the forestry department. The cruise, made from the stumps, gave very nearly the exact amount of timber having been removed. The work required the continuous services of an engineer and assistant for a month, and demanded the attention of a technical forester from this office for a period of fifteen days.

Educational Work With the State Library.

The State Librarian has received numerous requests from schools and clubs for slides and written talks on various subjects including forestry. Many of the pictures taken by the Forestry Department were chosen by the librarian, who subsequently had slides made from them. The forestry office has supplied suitable short talks to go with each picture and in such a way that a group of slides may be sent, accompanied conveniently by the descriptive papers, to any school making the request.

In addition to this, the Forestry Department has itself a great many slides illustrative of lumber conditions of the state, park and roadside planting, plantation enterprises, and forest fire protection work. Lectures are given by members of the State Forester's office from time to time, and appropriate slides used. Any request for such talks on forestry subjects before schools and clubs or associations will be gladly received and appointments made to meet the convenience of all concerned. The aim at present is to prepare lectures on highway and park planting for the various sections of the state; the pictures for this purpose are now being taken.

CITY TREE PLANTING.

Every one appreciates more or less the value of a shade tree. A few of the business men of Sacramento are expressing their appreciation by planting suitable ones in the very heart of the city's business section. A great many obstacles have stood in the way of "down town tree planting," the chief one being opposition from prejudiced people who have never experimented and who firmly believe the task too difficult to even warrant experiment. The question of the trees being undesirable by virtue of interfering with traffic has been another ditch to cross; leaves falling on the sidewalks are declared by many to constitute a nuisance, and this argument has had to be logically met. How can trees be planted in a sidewalk where the basement extends clear to the curb line? is a question which Sacramento has been answering. It can be done and is being done, and the trees are thriving, while former opponents to the principle of extending tree planting into the business district and onto the most congested streets are beginning to regard the pioneer work already done as successful. There will undoubtedly be a stimulated activity in this sort of planting from now on.

A great deal of credit is due to Mr. Charles K. McClatchy, editor of the Sacramento Bee, for his active and helpful interest in working for shade trees on his own business property and throughout the city.

Many of the problems encountered were brought to the State Forester's office until finally the execution of all the planting was supervised by the office.

Following are some of the queries:

1. What species are best suited to a congested street where soil is apt to possess a certain amount of leakage gas, and where sidewalks extend to the curb?

The oriental plane tree (Platanus orientalis) has been planted extensively in many European cities and has proved itself exceptionally hardy under apparently unfavorable conditions. Its root system renders it a safe tree to plant near sidewalks; the species does not require an abundance of soil moisture, its best development being made in a well drained and fertile soil; and it is seldom seriously injured by any slight amount of gas present in the soil. This tree has become the popular species for planting in the business districts of Sacramento. It also enjoys the reputation of shedding its leaves very rapidly, thus minimizing the period of any possible annoyance from falling foliage. The European linden is also being used, but it does not surpass or even equal the plane tree for this kind of planting. For these reasons most of the trees planted were of the latter species.

During the spring of 1916, 26 oriental planes were set out in the heart of Sacramento's business district. All have grown rapidly, and are now thrifty and of uniform development.

2. We would like to have shade trees in front of our place of business but the basement extends under the sidewalk to the curb line. How can trees that will grow 20 or 30 feet high be planted?

This problem has been solved, and those who had the work done already feel repaid for the expense of the undertaking. Sacrificing a space of about six feet back from the street wall of the basement and



After the first year. An Oriental Plane planted where the basement extends clear to the curb line. The owner already feels amply repaid for the expense of planting his trees, and they are greatly appreciated by the public. In the heart of Sacramento's business district.

about eight feet in width is necessary. A brick wall, three bricks in thickness and reinforced with strap iron on the corners, is built up from the basement floor to the sidewalk level, forming thus a great box. The floor of the "box" is broken; a large hole is opened through the original wall into and under the street; a three or four foot hole is carefully chiseled through the sidewalk; and the entire "box" filled with fresh and fertile soil and allowed to settle. Settling should be done with water and be allowed at least four days to be complete. The inner side of the "box" is waterproofed by a method well known to any mason. Trees planted under these conditions are making remarkable growth. The center of the circle in which the tree is planted should be about two or three feet from the curb line.

3. What is the best stock to buy from the nursery?

Experience has shown that best results can be obtained by planting young trees about eight feet high and an inch or a little over in diameter. Larger trees have to be pruned severely for shipment, and are set back further in their growth for the first year. Excellent growth has been made, however, by trees that were two inches and a half in diameter when planted. Healthy, well rooted and straight specimens should be selected.

4. How about tree guards and gratings?

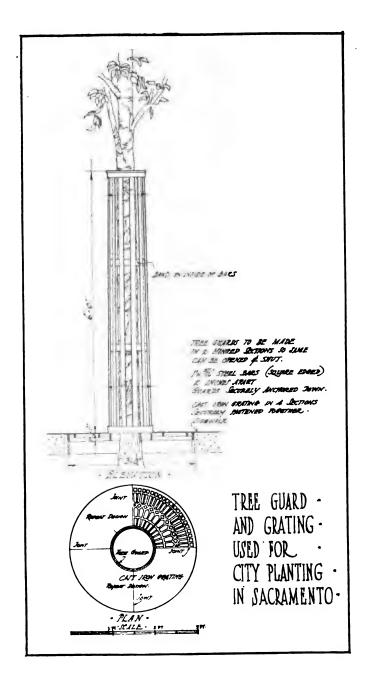
This is a matter of taste. We have adopted two styles of guards and gratings in Sacramento planting, cuts of which are shown with dimensions accompanying this report. These are very attractive, and extremely strong and rigid. The iron work was all done by a local foundry. There are simpler and less expensive styles; some prefer to use a strong wire mesh, but for congested sidewalks durability and firm anchorage are of prime importance.

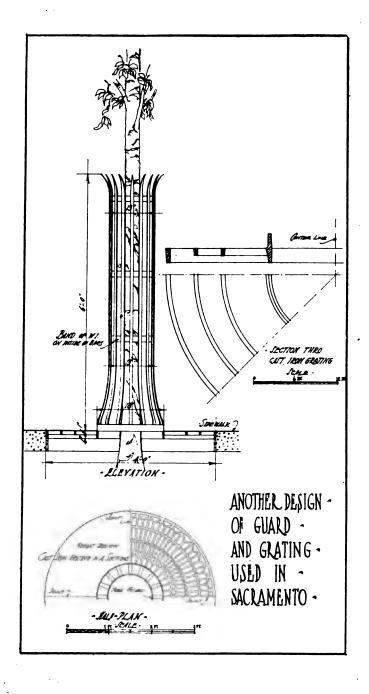
5. What does this sort of planting cost?

No attempt is made to evade the fact that such planting is expensive, but the cost is warranted and the value soon enjoyed in shade and beauty. The table following gives approximate figures of cost.

Table Showing Approximate Cost of City Tree Planting.

Item of cost	Cost per tree
Brickwork under sidewalk Chiseling through concrete sidewalk Filling in new earth, about five loads per "box," and figuring man and team at \$5 per day Tree guard and grating, 4 feet in diameter (including installation) Cost of tree Express, labor of planting, etc.	2 00 8 00
Total cost per tree	\$108 00





In a good many cases there is solid ground beneath the sidewalks—in which event the entire cost of brickwork and part of the filling-in cost can be subtracted. Under these circumstances it is well to take out at least a wagon load of the earth under the sidewalk and replace it with fresh soil. This method gives the young tree a most favorable start and gives the surrounding soil sufficient time to become thoroughly aerated.

The State Forester is glad to cooperate with any city or county on matters pertaining to highway and city planting, and will gladly offer advice whenever it is sought through the Forestry Department.

The following bill was passed in 1915, amending the shade and ornamental tree act.

Senate Bill No. 125.

CHAPTER 637.

An act to provide for the planting, protection, maintenance, removal and change of trees, shrubs, plants and grass along and in public streets, avenues, lanes, alleys, courts, places and pathways within municipalities, and providing a method for the assessment of the costs and expenses thereof.

[Approved June 7, 1915.]

The people of the state of California do enact as follows:

SECTION 1. All streets, avenues, lanes, alleys, courts, places and pathways within the municipalities of this state, now open or dedicated, or which may hereafter be opened or dedicated to public use, shall be deemed and held to be open public streets, avenues, lanes, alleys, courts, places and pathways for the purposes of this act, and the city council of each municipality of this state is hereby empowered to cause trees, shrubs, plants or grass to be planted, protected, maintained for a period of not exceeding five years, removed or changed, or to maintain existing trees, shrubs, plants and grass along and in said streets, avenues, lanes, alleys, courts, places and pathways, and is hereby invested with jurisdiction to order to be done thereon and therein any of the work mentioned in section two of this act in the manner and under the proceedings hereinafter described.

SEC. 2. Whenever the public interest or convenience may require, the city council of any municipality of this state is hereby authorized and empowered to order trees, shrubs, plants or grass to be planted, protected or maintained for a period of not exceeding five years, or removed or changed along and in the whole or any part of any such public street, avenue, lane, alley, court, place or pathway in such municipality; also to order suitable guards, coverings or gratings for the protection of said trees or shrubs, and to order any other work to be done which shall be necessary to plant, protect, maintain, remove or change, trees, shrubs, plants or grass along and in the whole or any part of any such public street, avenue, lane, alley, court, place or pathway, in such municipality.

SEC. 3. Before ordering any improvement to be made which is authorized by section two of this act, the city council shall adopt a resolution of intention so to do, briefly describing the proposed improvement, which may include the whole or any part of one or more such streets, avenues, lanes, alleys, courts, places or pathways, in any such municipality. Said proposed improvement may include any or all of the different kinds of work mentioned in section two of this act; provided, however, that the care of said trees, shrubs, plants or grass, shall be for a period stated in the resolution of intention, which shall not exceed five years; and provided, further, that it shall not be necessary to specify or describe in said resolution of intention the kind of trees, shrubs, plants or grass to be planted or removed or changed, their size or age or the method or manner of planting or removing or changing the same. The city council shall also, in the same resolution, refer the proposed improvement



The guard as it appears on the business streets of Sacramento. An Oriental Plane one year after planting. The guard is six feet in height and the grating three feet in diameter.

to the city engineer or other officer, board or commission designated by the said council, and direct said person, board or commission, to make and file with the clerk of the city council a report in writing presenting the following:

- 1. Plans and specifications for the work to be performed and the general method and manner of making the improvement.
- 2. An estimate of the cost of said improvement including the incidental expenses in connection therewith, and the annual cost of the maintenance thereof for a period not exceeding five years.
- 3. A diagram of the property affected or benefited by the proposed work or improvement and to be assessed to pay the expenses thereof, including the annual maintenance, if any; such diagram shall show each separate lot, piece or subdivision of land, and the relative location of the same to the work proposed to be done, all within the limits of the assessment district, each of which lots, pieces or subdivisions shall be given a separate number in red ink upon said diagram.
- 4. The proposed assessment of the total amount of the costs and expenses of the proposed improvement (including all incidental expenses) upon the lots, pieces or subdivisions of land within said assessment district as shown by said diagram, sufficient to cover the total expenses of the improvement. Each lot, piece or subdivision shall be separately assessed in proportion to the estimated benefits to be received by it. Said assessment shall refer to said lots, pieces or subdivisions of land upon said diagram by the respective red ink numbers thereof, and shall show the names of the owners, if known, otherwise designating them as unknown. No mistake in the name of the owner of any lot, piece or subdivision of land shall affect the validity of the assessment thereon.
- SEC. 4. In any municipality having a board, commission or officer in charge of tree planting, created by its charter, or by law or ordinance, the proposed improvement shall be referred to said board, commission or officer, and the report provided for in section three of this act shall be made and filed by said board, commission or officer.
- SEC. 5. Upon the filing of the report provided for in section three of this act, the clerk of the city council shall present the same to the city council for consideration, and said council may modify the same in any respect, and, in case of any such modification, the report as modified shall stand as the report for the purpose of all subsequent proceedings. Thereafter, the council, by resolution, shall appoint a time and place for hearing protests in relation to the proposed improvement, which time shall not be less than twenty days from the date of the passage of said resolution, and shall direct the clerk of the city council to give notice of said hearing, and shall designate the newspaper in which such notice shall be published.
- Sec. 6. After the passage of the resolution mentioned in section five of this act. the superintendent of streets of said city shall cause to be conspicuously posted along all streets, avenues, lanes, alleys, courts, places and pathways, or parts thereof. included in said resolution of intention, at not more than three hundred feet in distance apart, but not less than three in all upon each such street, avenue, lane, alley, court, place and pathway, notices of the passage of said resolution of intention and of the filing of said report. Said notices shall be headed "Notice of Parkway Improvement," in letters not less than one inch in length, shall be in legible characters, and shall state the fact and date of the passage of said resolution of intention and of the filing of said report, and the day and hour set for the hearing of said protests, and briefly describe the improvement proposed and refer to said resolution and report for further particulars. He shall also cause a notice similar in substance to be published for a period of two days in a daily newspaper published and circulated in said municipality and designated by said city council for that purpose, or if there is no daily newspaper in said municipality, then by one insertion in a weekly paper, so published, circulated and designated. Said notices must be posted and published, as above provided, at least ten days before the date set for the hearing of said protests. In case there is no daily or weekly newspaper published and circulated in said city, then said notice shall be posted in three of the

most public places in such city at least ten days before the dates set for the hearing of said protest.

SEC. 7. Any person, interested, objecting to said improvement, or to the proposed assessment provided for in section three hereof, may file a written protest with the clerk of the city council at or before the time set for the hearing referred to in section five hereof. The clerk shall indorse on every such protest the date of its reception by him, and at the time appointed for said hearing shall present to said city council all protests so filed with him. If such protests are against said improvement, and said city council finds that the same are signed by the owners of a majority of the frontage of the property fronting on streets or parts of streets within said assessment district, all further proceedings under said resolution of intention shall be barred and no new resolution of intention for the same improvement shall be passed within six months after the presentation of such protests to the city council, unless the owners of a majority of the frontage of the property fronting on streets or parts of streets within said assessment district shall in the meantime petition therefor. If such protests are against the improvement, and the council finds that they are not signed by the owners of a majority of the frontage of the property fronting on streets or parts of streets within said assessment district, the council shall hear said protests at the time appointed therefor, as above provided, or at any time to which the hearing thereof may be adjourned and pass upon the same, and its decision shall be final and conclusive, and if such protests are sustained the proceedings shall be abandoned, but may be renewed at any time, and if such protests are denied, the proposed assessment shall be confirmed. If such protests are against the proposed assessment, the council shall hear said protests at the time appointed therefor, as above provided, or at any time to which the hearing thereof may be adjourned, and may confirm or correct said proposed assessment; provided, however, that they shall not alter the same so as to provide for the doing of any kind of work not included in said report or the doing of work upon any street, avenue, lane, alley, court, place or pathway, or portion thereof not included in said report and shall not increase the amount to be raised above the amount specified in said report. When, upon the hearing, said proposed assessment is confirmed or corrected, or in case no protests have been filed and the report provided for in section three hereof has been adopted as a whole with any modifications or corrections that have been made therein, the city council shall by resolution declare its action upon said report, order said proposed improvement to be made and levy said assessment upon the lots, parts of lots and subdivisions of land fronting upon the streets, avenues, lanes, alleys, courts, places and pathways, or parts thereof, along and in which said improvement is to be made. Said resolution shall be final and conclusive upon all persons.

SEC. 8. The validity of an assessment levied under this act shall not be contested in any action or proceeding unless the same is commenced within thirty days after the time said assessment is levied, and any appeal from a final judgment in such action or proceeding must be perfected within thirty days after the entry of such judgment.

SEC. 9. Upon the passage of the resolution provided for in section seven hereof, the clerk of said city council shall transmit to the tax collector of the municipality, the diagram and assessment provided for in subdivisions three and four of section three hereof, and any modifications or corrections thereof made by the city council. Thereupon the tax collector shall annually enter said assessments upon the assessment roll upon which other taxes of said city are entered, and the same shall be annually collected in the same manner as such other taxes are collected. Such entry and collection to be made at the same time and by the same officers as in the case of other city taxes.

SEC. 10. All sums collected on account of such assessment shall be placed in the city treasury to the credit of a special fund, which shall be designated by the name of the proposed improvement. The city council shall cause to be paid or transferred to such special fund from any other available funds in the city treasury as soon as

needed, such part of the cost of such proposed work as has theretofore been ordered to be paid out of the city treasury. Said special fund shall be used only for paying the costs and expenses of the work described in the resolution ordering the work to be done, including the cost of all posting and publication herein provided for, and any other incidental expenses of the work. If the amount raised is insufficient to pay the whole of such costs and expenses, the city council may provide for such deficiency by an appropriation out of the general fund of such city, or may take further proceedings to raise the amount of such deficiency by ordering a supplementary assessment to be made upon the same property in the same manner and form and subject to the same procedure as the original assessment, but on such proceedings no report shall be necessary from the person or board making the original report specified in section three hereof, except an estimate of the deficiency, and no protest shall be received except as to the amount of money necessary to complete the work. The city council may at any time advance to such special fund out of any available funds in the city treasury, sums in excess of the amount to be paid by the city towards the cost of such work and may reimburse the city for such advances by repaying the same out of any money that may thereafter come into such special fund.

SEC. 11. At any time after the funds for the work or any part of the work, shall be in the city treasury, or if the municipality has advanced the money from the general fund as a loan to said special fund, the municipality shall itself without awarding a contract therefor, execute and perform the work embraced in the plans and specifications contained in the report provided for in sections three and four of this act, in accordance with said plans and specifications, and employ the labor, and provide the nursery stock, material and supplies necessary therefor, or at its option do the work or any portion thereof by contract let in the manner provided by the charter of said municipality or the law under which the said municipality is organized. The work must be done under the supervision, direction and control of the board, commission or officer by whom the report provided for in section three of this act was made, and no work shall be paid for except upon the order and approval of said board, commission or officer.

SEC. 12. Every assessment levied under this act shall from the date of the levy thereof he a lien upon the land upon which it is levied in the same manner and to the same effect as other city taxes are a lien upon said land. And such lien shall continue and be enforced in the same manner as other taxes of said city are continued and enforced.

SEC. 13. The following words and phrases shall, where used in this act, have the following meanings:

- (1) The terms "municipality" and "city" include all corporations heretofore organized and now existing, and those hereafter organized, for municipal purposes.
- (2) The terms "council" and "city council" include any body or board in which by law is vested the legislative power of any city.
- (3) The terms "treasurer" and "city treasurer" include any person or officer who has charge and makes payments of the city funds.
- (4) The term "city engineer" includes any person or officer who has charge of the surveying and engineering work of said city.
- (5) The terms "clerk" and "city clerk" include any person or officer who shall be clerk of the said council.
- (6) The term "improvement" includes all work and improvements mentioned in section two of this act.
- (7) The term "incidental expenses" shall include the cost and expense of making the report mentioned in sections three and four hereof, including fees for surveying and engineering work; also the cost of printing and publishing as provided herein; also the expenses of making the assessment for any work authorized by this act.
- (8) The term "owner" and "any person interested" includes the person owning the fee, or the person in whom, on the day any protest or petition is filed, the legal title to real property appears, by deeds duly recorded in the county recorder's office of the county in which said city is situated, or any person in possession of real

property, as the executor, administrator, trustee under an express trust, guardian or other legal representative of the owner, or any person in possession of real property under a written contract of purchase thereof duly recorded, or any person in possession of real property as lessee thereof under a lease duly recorded, which shall require such lessee to pay or dischage all assessments for street or other public improvements, that may be levied or assessed against such real property.

(9) Any act required herein to be performed by resolution may be performed by ordinance with the same force and effect.

SEC. 14. Proof of publication of any notice required by this act shall be made by affidavit, as provided in the Code of Civil Procedure, and proof of the posting of any such notice shall be made by the affidavit of the person posting the same, setting forth the facts regarding such posting. It shall be the duty of any officer who is required by this act to have any notice published or posted, to obtain and file in his office the affidavit or affidavits in proof thereof; provided, that his failure so to do shall not affect the validity of any proceedings under this act. Any such affidavit so filed shall be prima facie evidence of the facts therein stated regarding such publication or posting.

SEC. 15. This act shall in no wise affect an act entitled "An act to provide for the planting, maintenance, and care of shade trees upon streets, lanes, alleys, courts and places within municipalities, and of hedges upon the lines thereof; also, for the eradication of certain weeds within city limits," approved March 11, 1893, or any act amendatory thereof or supplementary thereto, or any other acts on the same subject, or apply to proceedings had thereunder, but it is intended to and does provide an alternate system of proceedings for making the improvements provided for by this act; and it shall be within the discretion of the city council of any municipality to proceed in making such improvements, either under the provisions of this act, or under the provisions of such other acts; but when any proceedings are commenced under this act, the provisions of this act, and of such amendments thereof as may be hereafter adopted, and no other, shall apply to all such proceedings, and any provisions contained in said acts or any acts in conflict with the provisions hereof shall be void and of no effect as to the proceedings commenced under the provisions of this act. The election of the city council to proceed under the provisions of this act shall be expressed in its resolution of intention to order the work done.

SEC. 16. The provisions of this act shall be liberally construed to promote the objects thereof, and no publication or notice other than that provided for in this act shall be necessary to give validity to any proceedings had thereunder. This act may be designated and referred to as the "Tree Planting Act of 1915."

Senate Bill No. 1737.

CHAPTER 314.

An act to provide for the planting, protection and care, and the removal and change, of shade trees and ornamental shrubs along and in public streets, avenues, lanes, alleys, courts and places within municipalities, and for the assessment of the costs and expenses thereof upon the lots, parts of lots and lands fronting on the public streets, avenues, lanes, alleys, courts or places where such work is to be done.

[Approved June 11, 1913.]

The people of the state of California do enact as follows:

SECTION 1. All streets, avenues, lanes, alleys, courts and places within the municipalities of this state, now open or dedicated, or which may hereafter be opened or dedicated to public use, shall be deemed and held to be open public streets, avenues, lanes, alleys, courts, and places for the purposes of this act, and the city council of each municipality of this state is hereby empowered to cause shade trees and ornamental shrubs to be planted, protected and cared for, and removed and changed, along and in said streets, avenues, lanes, alleys, courts and places, for which grades have been officially established, and which have been actually graded in conformity



Oriental Plance one year old planted on the main street of Sacramento. The Post Office. In two or three years these trees will be invaluable as shade trees; they will always be ornamental.

therewith, and is hereby invested with jurisdiction to order to be done thereon and therein any of the work mentioned in section two of this act in the manner and under the proceedings hereinafter described.

- SEC. 2. Whenever the public interest or convenience may require, the city council of any municipality of this state is hereby authorized and empowered to order shade trees and ornamental shrubs to be planted, protected, and cared for, and to be removed and changed, along and in the whole or any part of any such public street, avenue, lane, alley, court or place in such municipality; also to order suitable guards, covering or grating for the protection of said trees and shrubs, and to order any other work to be done which shall be necessary to plant, protect and care for, and to remove and change, shade trees and ornamental shrubs along and in the whole or any part of any such public street, avenue, lane, alley, court or place in such municipality.
- SEC. 3. Before ordering any improvement to be made which is authorized by section two of this act, the city council shall adopt a resolution declaring its intention to do so, briefly describing the proposed improvement, which may include the whole or any part of one or more such streets, avenues, lanes, alleys, courts or places in any such municipality. Said proposed improvement may include any or all of the different kinds of work mentioned in section two of this act; provided, however, that the care of said trees and shrubs shall be for a period stated in the resolution of intention, which shall not exceed five years; and provided, further, that it shall not be necessary to specify or describe in said resolution of intention the kind of trees or shrubs to be planted or removed or changed, their size or age or the method or manner of planting or removing or changing them. The city council shall also, in the same resolution, refer the proposed improvement to the city engineer, and direct him to make and file with the clerk of the city council a report in writing, presenting the following:
- 1. Plans and specifications for the work required in order to make said improvement, which shall include a specification of the kind of trees or shrubs to be used in and covered by the improvement, their approximate age, size and the general method or manner of making the improvement.
- 2. An estimate of the cost of said improvement, and of the incidental expenses in connection therewith
- 3. A diagram, exhibiting the streets, avenues, lanes, alleys, courts and places, or the parts thereof, along and in which said improvement is proposed to be made, and showing the boundaries and frontage of the lots, parts of lots and lands fronting thereon, each of which subdivisions shall be given a separate number in red ink upon said diagram.
- 4. A proposed assessment of the total amount of the costs and expenses of the proposed improvement (including all incidental expenses) upon the lots, parts of lots and lands fronting upon the streets, avenues, lanes, alleys, courts and places, or parts thereof, along and in which said improvement is to be made, at a rate per front foot sufficient to cover the total expenses of the improvement. Each subdivision shall be separately assessed in proportion to its frontage. Said assessment shall refer to said subdivisions upon said diagram by the respective red ink numbers thereof, and shall show the names of the owners, if known, otherwise designating them as unknown. No mistake in the name of the owner of any subdivision of land shall affect the validity of the assessment thereon.
- SEC. 4. In any municipality having a board, commission or officer in charge of tree planting, created by its charter or by law, the proposed improvement shall be referred to said board, commission or officer, and the report provided for in section three of this act shall be made and filed by said board, commission or officer.
- SEC. 5. Upon the filing of the report provided for in section three of this act, the said clerk shall present the same to the city council for consideration, and said council may modify the same in any respect, and in case of any such modification, the report as modified shall stand as the report for the purpose of all subsequent proceedings. Thereafter, the council, by resolution, shall appoint a time and place for hearing protests in relation to the proposed improvement, which time shall not

be less than twenty days from the date of the passage of said resolution, and shall direct the clerk of the city council to give notice of said hearing, and shall designate the newspaper in which such notice shall be published.

SEC. 6. After the passage of the resolution mentioned in section five of this act, the clerk of said city council shall cause to be conspicuously posted along all streets, avenues, lanes, alleys, courts and places, or parts thereof, included in said resolution of intention, at not more than three hundred feet in distance apart, notices (not less than three in all), of the passage of said resolution of intention and of the filing of said report. Said notices shall be headed "Notice of local improvement," in letters not less than one inch in length, shall be in legible characters, and shall state the fact and date of the passage of said resolution of intention and of the filing of said report, and the date set for the hearing of said protests, and briefly describe the improvement proposed and refer to said resolution and report for further particulars. He shall also cause a notice similar in substance to be published for a period of two days in a daily newspaper published and circulated in said municipality and designated by said city council for that purpose, or if there is no daily newspaper in said municipality, then by two successive insertions in a weekly paper, so published, circulated and designated. Said notices must be posted and published, as above provided, at least ten days before the date set for the hearing of said protests. In case there is no daily or weekly newspaper published and circulated in said city, then said notice shall be posted in three of the most public places in such city at least ten days before the dates set for the hearing of said protest.

SEC. 7. Any person interested, objecting to said improvement, or to the proposed assessment provided for in section three hereof, may file a written protest with the clerk of the city council at or before the time set for the hearing referred to in section five hereof. The clerk shall indorse on every such protest the date of its reception by him, and at the time appointed for said hearing shall present to said city council all protests so filed with him. If such protests are against said improvement, and said city council finds that the same are signed by the owners of a majority of the frontage of the property fronting on said proposed improvement, all further proceedings under said resolution of intention shall be barred and no new resolution of intention for the same improvement shall be passed within six months after the presentation of such protests to the city council, unless the owners of a majority of the frontage of the property fronting on said proposed improvement shall in the meantime petition therefor. If such protests are against the improvement, and the council finds that they are not signed by the owners of a majority of the frontage of the property fronting on said proposed improvement, the council shall hear said protests at the time appointed therefor, as above provided, or at any time to which the hearing thereof may be adjourned, and pass upon the same, and its decision shall be final and conclusive, and if such protests are sustained the proceedings shall be abandoned, but may be renewed at any time, and if such protests are denied, the proposed assessment shall be confirmed. If such protests are against the proposed assessment, the council shall hear said protests at the time appointed therefor, as above provided, or at any time to which the hearing thereof may be adjourned, and may confirm or correct said proposed assessment. upon the hearing, said proposed assessment is confirmed or corrected, or in case no protests are filed, the report provided for in section three hereof shall be adopted as a whole, with any modifications or corrections that have been made therein and the city council shall, by resolution, order said proposed improvement to be made. and declare its action upon said report and assessment, which resolution shall be final and conclusive on all persons, and the assessment shall be thereby levied upon the lots, parts of lots and lands fronting upon the streets, avenues, lanes, alleys, courts and places, or parts thereof, along and in which said improvement is to be made.

SEC. 8. The validity of an assessment levied under this act shall not be contested in any action or proceeding unless the same is commenced within thirty days after the time said assessment is levied, and any appeal from a final judgment in such an action or proceeding must be perfected within thirty days after the entry of such judgment.

SEC. 9. Upon the passage of the resolution provided for in section seven hereof, the clerk of said city council shall transmit to the tax collector of the municipality, the diagram and assessment provided for in subdivisions 3 and 4 of section three hereof, and any corrections thereof made by the city council.

SEC. 10. Upon the receipt of the diagram and assessment referred to in the last preceding section, the tax collector of the municipality shall record the same in a substantial book, to be kept for that purpose, in his office, and shall thereupon fix a day not less than twenty, nor more than thirty, days from the date of the receipt by him of said diagram and assessment, after which all assessments unpaid shall become delinquent and ten per cent shall be added to the amount thereof, and shall also fix a day for the sale of the various parcels of land upon which the assessments are unpaid, which said date shall be not less than fifty days nor more than sixty days from the date of the receipt by him of said diagram and assessment.



If a tree is worth anything, should it be treated this way?

SEC. 11. Notice of the sale of property upon which the said assessments are delinquent shall be given by said tax collector by posting and publication in the manner now provided by the general laws of the state of California, for giving notice of sale of real estate upon execution; provided, however, that the descriptions of the various parcels of land need not be set out at length, but only by the respective numbers of the same as they appear upon the assessment and diagram, which shall be properly referred to in said notice, and said descriptions shall all be contained in one notice. At the time and place fixed for the sale of said property, the tax collector shall separately sell the respective parcels of land, the assessments against which have not been paid, or so much of each parcel as shall be necessary to realize the amount assessed against said parcel, said ten per cent penalty for delinquency, and its proportion of the expenses of sale, in the order of their numbers upon said diagram. At said sale the municipality may be a purchaser.

SEC. 12. The tax collector shall issue for each sale an original and a duplicate certificate of sale, referring to the proceedings, describing the parcel sold, and giving the name of the purchaser and the amount for which said parcel was sold. The original certificate he shall deliver to the purchaser, and the duplicate he shall keep on file in his office in the form of a stub in the certificate book.

- SEC. 13. At any time before the expiration of one year from the date of the sale, any property sold under the provisions of the preceding sections may be redeemed by the payment to the tax collector of the amount for which the property was sold, with an additional penalty of twenty-five per cent of said amount. Said redemption money shall be paid by the tax collector to the person holding the original certificate of sale upon his delivering up the same and receipting for the amount received from the tax collector therefor. Upon redemption of any parcel of land the tax collector shall enter the fact and date of such redemption upon the duplicate certificate of sale thereof.
- SEC. 14. If the property is sold, and is not redeemed within said period of one year from the date of the sale, the tax collector shall execute to the person named in the original certificate, or to his assignee, a deed of the property described in said certificate, which said deed shall refer in general terms to the proceedings under which the same is issued, and shall contain a description of the property. Such deed shall convey title in fee to said property, and the grantee is immediately, upon the receipt thereof, entitled to possession of the property described therein.
- SEC. 15. The funds collected by the tax collector under the proceedings herein provided for, either upon voluntary payment, or as the result of sales, shall be paid by said tax collector as fast as collected to the treasurer of said municipalities, who shall place the same in a special fund designated by the city council, and payments shall be made out of said special fund only for the purposes provided for in this act. To expedite the making of any such improvement, the city council may at any time transfer into said special fund, out of any money in the general fund, such sums as it may deem necessary, and the sums so transferred shall be deemed a loan to such special fund and shall be repaid out of the proceeds of the assessments provided for in this act.
- SEC. 16. At any time after the funds for the work, or any part of the work, shall be in the hands of said treasurer, the municipality shall itself execute and perform the work embraced in the plans and specifications contained in the report provided for in sections three and four of this act, in accordance with said plans and specifications, and employ the labor, and provide the nursery stock, material and supplies necessary therefor. The cost and expenses of such work shall be paid out of said special fund; and in case of a deficiency in the fund for such improvement, the city council, in its discretion, may provide for such deficiency by an appropriation out of the general fund of the treasury, or by ordering a supplementary assessment to be made upon the same property, in the same manner and form, and subject to the same procedure as the original assessment; and in the last named case, in order to avoid delay, the city council may advance such deficiency out of any money in the general fund of the treasury, and reimburse the treasury from the collections under such supplementary assessment. The work must be done under the supervision, direction and control of the board, commission or officer by whom the report provided for in section three of this act was made, and no work shall be paid for except upon the order and approval of said board, commission or officer.
- Sec. 17. If at any time an assessment for any such improvement shall realize a larger sum than is necessary therefor, the excess shall be refunded pro rata to the parties by whom it was paid.
- SEC. 18. Every special assessment levied under this act shall, from the date of the levy thereof, be a lien upon the land upon which it is levied paramount to all other liens, except prior assessments and taxation, and such lien shall continue until such special assessment is paid, or until the property is sold and a deed is made therefor to the purchaser as hereinbefore provided, and all parties shall have constructive notice of such lien from the date of the passage of the resolution referred to in section seven hereof.
- SEC. 19. The following words and phrases shall, where used in this act, have the following meanings:
- (1) The terms "municipality" and "city" include all corporations heretofore organized and now existing, and those hereafter organized, for municipal purposes.

- (2) The terms "council" and "city council" include any body or board in which by law is vested the legislative power of any city.
- (3) The terms "treasurer" and "city treasurer" include any person or officer, who has charge and makes payments of the city funds.
- (4) The term "city engineer" includes any person or officer, who has charge of the surveying and engineering work of said city.
- (5) The terms "clerk" and "city clerk" include any person or officer who shall be clerk of the said council.
- (6) The term "improvement" includes all work and improvements mentioned in section two of this act.
- (7) The term "incidental expenses" shall include the cost and expense of making the report mentioned in sections three and four hereof, including tees for surveying and engineering work; also the cost of printing and publishing as provided herein; also the expenses of making the assessment for any work authorized by this act.
- (8) The term "owner" and "any person interested" included the person owning the fee, or the person in whom, on the day any protest or petition is filed, the legal title to real property appears, by deeds duly recorded in the county recorder's office of the county in which said city is situated, or any person in possession of real property, as the executor, administrator, trustee under an express trust, guardian or other legal representative of the owner, or any person in possession of real property under a written contract of purchase thereof duly recorded, or any person in possession of real property, as lessee thereof under a lease duly recorded, which shall require such lessee to pay or discharge all assessments for street or other public improvements, that may be levied or assessed against such real property.
- SEC. 20. Proof of publication of any notice required by this act shall be made by affidavit, as provided in the Code of Civil Procedure, and proof of the posting of any such notice shall be made by the affidavit of the person posting the same, setting forth the facts regarding such posting. It shall be the duty of any officer who is required by this act to have any notice published or posted, to obtain and file in his office the affidavit or affidavits in proof thereof; provided, that his failure so to do shall not affect the validity of any proceedings under this act. Any such affidavit so filed shall be prima facie evidence of the facts therein stated regarding such publication or posting.
- SEC. 21. This act shall in no wise affect an act entitled "An act to provide for the planting, maintenance, and care of shade trees upon streets, lanes, alleys, courts and places within municipalities, and of hedges upon the lines thereof; also, for the eradication of certain weeds within city limits," approved March 11, 1893, or any act amendatory thereof or supplementary thereto, or any other acts on the same subject, or apply to proceedings had thereunder, but it is intended to and does provide an alternate system of proceedings for making the improvements provided for by this act; and it shall be within the discretion of the city council of any municipality to proceed in making such improvements, either under the provisions of this act, or under the provisions of such other acts; but when any proceedings are commenced under this act, the provisions of this act, and of such amendments thereof as may be hereafter adopted, and no other, shall apply to all such proceedings, and any provisions contained in said acts or any acts in conflict with the provisions hereof shall be void and of no effect as to the proceedings commenced under the provisions of this act. The election of the city council to proceed under the provisions of this act shall be expressed in its resolution of intention to order the work done.
- SEC. 22. The provisions of this act shall be liberally construed to promote the objects thereof, and no publication or notice other than that provided for in this act shall be necessary to give validity to any proceedings had thereunder. This act may be designated and referred to as the "tree planting act of 1913."

Assembly Bill No. 1606.

CHAPTER 759.

An act to amend an act entitled "An act to provide for the planting, protection and care, and the removal and change, of shade trees and ornamental shrubs along and in public streets, avenues, lanes, alleys, courts and places within municipalities, and for the assessment of the costs and expenses thereof upon the lots, parts of lots and lands fronting on the public streets, avenues, lanes, alleys, courts or places where such work is to be done," approved June 11, 1913, by providing for the planting, protection, and care, and the removal and change of trees, shrubs, plants and grass along and in public streets, avenues, lanes, alleys, courts, places and pathways, within municipalities, and for the assessment of the cost and expenses thereof upon the lots, parts of lots, and lands within the district assessed, in proportion to the benefits to be received where such work is to be done, by amending the title of said act and by amending sections one, two, three, four, six, seven and sixteen thereof.

[Approved June 12, 1915.]

The people of the state of California do enact as follows:

SECTION 1. The title of that certain act entitled "An act to provide for the planting, protection and care, and the removal and change, of shade trees and ornamental shrubs along and in public streets, avenues, lanes, alleys, courts and places within municipalities, and for the assessment of the costs and expenses thereof upon the lots, parts of lots and lands fronting on the public streets, avenues, lanes, alleys, courts or places where such work is to be done," approved June 11, 1913, is hereby and to read as follows: "An act to provide for the planting, protection, and care, and the removal and change of trees, shrubs, plants and grass along and in public streets, avenues, lanes, alleys, courts, places and pathways, within municipalities, and for the assessment of the cost and expenses thereof upon the lots, parts of lots, and lands within the district assessed, in proportion to the benefits to be received where such work is to be done."

SEC. 2. Section one of said act entitled "An act to provide for the planting, protection and care, and the removal and change, of shade trees and ornamental shrubs along and in public streets, avenues, lanes, alleys, courts and places within municipalities, and for the assessment of the costs and expenses thereof upon the lots, parts of lots and lands fronting on the public streets, avenues, lanes, alleys, courts or places where such work is to be done" is hereby amended to read as follows:

Section 1. All streets, avenues, lanes, alleys, courts, places or pathways within the municipalities of this state, now open or dedicated, or which may hereafter be opened or dedicated to public use, shall be deemed and held to be open public streets, avenues, lanes, alleys, courts, places or pathways for the purposes of this act, and the city council of each municipality of this state is hereby empowered to cause trees, shrubs, plants or grass to be planted, protected and cared for, and removed and changed, or to care for and maintain trees, shrubs, plants or grass, along and in said streets, avenues, lanes, alleys, courts, places and pathways and is hereby invested with jurisdiction to order to be done thereon and therein any of the work mentioned in section two of this act in the manner and under the proceedings hereinafter described.

SEC. 3. Section two of said act is hereby amended to read as follows:

Section 2. Whenever the public interest or convenience may require, the city council of any municipality of this state is hereby authorized and empowered to order trees, shrubs, plants or grass to be planted, protected, and cared for, and to be removed or changed, along and in the whole or any part of any such public street, avenue, lane, alley, court, place or pathway in such municipality; also to order suitable guards, coverings, or grating for the protection of said trees, ahrubs, plants or grass, and to order any other work to be done which shall be necessary to plant, protect or care for, and to remove or change, trees, ahrubs, plants or

grass, along and in the whole or any part of any such public street, avenue, lane, alley, court, place or pathway in such municipality.

SEC. 4. Section three of said act is hereby amended to read as follows:

- Section 3. Before ordering any improvements to be made which is authorized by section two of this act the city council shall adopt a resolution declaring its intention to do so, briefly describing the proposed improvement, which may include the whole or any part of one or more such streets, avenues, lanes, alleys, courts, places or pathways in any such municipality. Said proposed improvement may include any or all of the different kinds of work mentioned in section two of this act; provided, however, that the care of said trees, shrubs, plants or grass shall be for a period stated in the resolution of intention, which shall not exceed five years; and provided, further, that it shall not be necessary to specify or describe in said resolution of intention the kind of trees, shrubs, plants or grass to be planted or removed or changed, their size or age or the method or manner of planting or removing or changing them. The city council shall also, in the same resolution, refer the proposed improvement to the city engineer, or other officer, board, or commission, designated by said council as provided in section four herein, and direct such person, board or commission to make and file with the clerk of the city council a report in writing, presenting the following:
- 1. Plans and specifications for the work to be performed and the general method or manner of making the improvement.
- 2. An estimate of the cost of said improvement, and of the incidental expenses in connection therewith.
- 3. A diagram of the property affected or benefited by the proposed work of improvement, which diagram shall show each separate lot, piece or parcel of land, and the relative location of the same to the work proposed to be done, all within the limits of the assessment district, each of which subdivisions shall be given a separate number in red ink upon said diagram.
- 4. The proposed assessment of the total amount of the costs and expenses of the proposed improvement (including all incidental expenses) upon the lots, parts of lots, and lands within said assessment district as shown by said diagram sufficient to cover the total expenses of the improvement. Each of said lots, parts of lots, and lands shall be separately assessed in proportion to the estimated benefits to be received by it. Said assessment shall refer to said lots, parts of lots and lands upon said diagram by the respective red ink number thereof, and shall show the names of the owners, if known, otherwise designating them as owners. Any mistake in the name of the owner of any lots, parts of lots, or lands shall not affect the validity of the assessment thereon.
 - SEC. 5. Section four of said act is hereby amended to read as follows:
- Section 4. In any municipality having a board, commission or officer in charge of tree planting, created by its charter or by law or ordinance, the proposed improvement shall be referred to said board, commission or officer, and the report provided for in section three of this act shall be made and filed by said board, commission or officer.
 - SEC. 6. Section six of said act is hereby amended to read as follows:
- Section 6. After the passage of the resolution mentioned in section five of this act, the clerk of said council shall cause to be conspicuously posted along all streets, avenues, lanes, alleys, courts, places or pathways, or parts thereof, included in said resolution of intention, at not more than three hundred feet in distance apart, notices (not less than three in all), of the passage of said resolution of intention and of the filing of said report. Said notices shall be headed "Notice of local improvement," in letters not less than one inch in length, shall be in legible characters, and shall state the fact and date of the passage of said resolution of intention and of the filing of said report, and the date set for the hearing of said protests, and briefly describe the improvement proposed and refer to said resolution and report for further particulars. He shall also cause a notice similar in substance to be published for a period of two days in a daily newspaper published and circulated

in said municipality and designated by said city council for that purpose, or if there is no daily newspaper in said municipality, then by two successive insertions in a weekly paper, so published, circulated and designated. Said notices must be posted and published, as above provided, at least ten days before the date set for the hearing of said protests. In case there is no daily or weekly newspaper published and circulated in said city, then said notice shall be posted in three of the most public places in such city at least ten days before the date set for the hearing of said protest.

SEC. 7. Section seven of said act is hereby amended to read as follows:

Section 7. Any person interested, objecting to said improvement, or to the proposed assessment provided for in section three hereof, may file a written protest with the clerk of the city council at or before the time set for the hearing referred to in section five hereof. The clerk shall indorse on every such protest the date of its reception by him, and at the time appointed for said hearing shall present to said city council all protests so filed with him. If such protests are against said improvement, and said city council finds that the same are signed by the owners of a majority of the property fronting on the streets, avenues, lanes, courts, places and pathways, or parts thereof, within said assessment district, all further proceedings under said resolution of intention shall be barred and no new resolution of intention for the same improvement shall be passed within six months after the presentation of such protests to the city council, unless the owners of a majority of the property fronting on the streets, avenues, lanes, courts, places and pathways, or parts thereof, within said assessment district, shall in the meantime petition therefor. If such protests are against the improvement, and the council finds that they are not signed by the owners of a majority of the frontage of the property fronting on said proposed improvement, the council shall hear said protests at the time appointed therefor, as above provided, or at any time to which the hearing thereof may be adjourned, and pass upon the same, and its decision shall be final and conclusive, and if such protests are sustained the proceedings shall be abandoned, but may be renewed at any time, and if such protests are denied, the proposed assessment shall be confirmed. If such protests are against the proposed assessment, the council shall hear said protests at the time appointed therefor, as above provided. or at any time to which the hearing thereof may be adjourned, and may confirm or correct said proposed assessment; provided, however, that they shall not alter the same so as to provide for the doing of any kind of work not included in said report, or the doing of work upon any street, avenue, lane, alley, court, place or pathway, or parts thereof, not included in said report, and shall not increase the amount to be raised above the amount specified in said report. When, upon the hearing, said proposed assessment is confirmed or corrected, or in case no protests are filed, the report provided for in section three hereof shall be adopted as a whole. with any modifications or corrections that have been made therein and the city council shall, by resolution, order said proposed improvement to be made, and declare its action upon said report and assessment, which resolution shall be final and conclusive on all persons, and the assessment shall be thereby levied upon the lots, parts of lots and lands fronting upon the streets, avenues, lanes, alleys, courts and places, or parts thereof, along and in which said improvement is to be made.

SEC. 8. Section sixteen of said act is hereby amended to read as follows:

Section 16. At any time after the funds for the work, or any part of the work, shall be in the hands of said treasurer, the municipality shall itself execute and perform the work embraced in the plans and specifications contained in the report-provided for in sections three and four of this act, in accordance with said plans and specifications without awarding a contract therefor and employ the labor, and provide the nursery stock, material and supplies necessary therefor, or at its option do the work or any portion thereof by contract let in the manner employed by the charter of said municipality, or the law under which the said municipality is organized. The cost and expenses of such work shall be paid out of said special fund; and in the case of a deficiency in the fund for such improvement, the city council, in its discretion, may provide for such deficiency by an appropriation out

of the general fund of the treasury, or by ordering a supplementary assessment to be made upon the same property, in the same manner and form, and to the same effect.

in said municipality and designated by said city council for that purpose, or if there is no daily newspaper in said municipality, then by two successive insertions in a

reganized. The cost and expenses of such work shall be paid out of said special fund; and in the case of a deficiency in the fund for such improvement, the city council, in its discretion, may provide for such deficiency by an appropriation out

of the general fund of the treasury, or by ordering a supplementary assessment to be made upon the same property, in the same manner and form, and to the same effect, and subject to the same procedure as the original assessment; and in the last named case, in order to avoid delay, the city council may advance such deficiency out of any money in the general fund of the treasury, and reimburse the treasury from the collections under such supplementary assessment. The work must be done under the supervision, direction and control of the board, commission or officer by whom the report provided for in section three of this act was made, and no work shall be paid for except upon the order and approval of said board, commission or officer.

EUCALYPTUS INVESTIGATIONS.

A few years ago there was an active interest in California in growing eucalyptus trees. The heralded good qualities of the species—their fast growth and diversified usages—prompted the organization of several growing concerns throughout the state. Large areas and smaller ones were planted to various eucalyptus species. In many cases stock was issued and sold in these plantation enterprises.

Recently the State Forester has been receiving repeated requests for information concerning this or that tract—its present status as a eucalyptus plantation—until in the spring of 1916 he started an investigation in order to be able to answer some of the numerous queries.

Of the thirty-two commercial plantations of which we have record, eighteen have been visited and investigated. The investigation for each plantation was as follows:

- 1. Sample plots were taken in each species of each plantation, and soil conditions, method of care, age and condition of trees carefully noted.
 - 2. The present ownership was determined.
 - 3. The acreage in each case was ascertained and location noted.
- 4. Care was taken to determine in each case whether the plantation is still being figured as a commercial proposition.
- 5. The data collected shows the manner in which the individual companies were operated and the management the respective plantations have been subject to.
- 6. The present status of the property, its apparent value and use, was noted.

The other fourteen, among which are some of the largest plantations in the state, will be visited and similar information obtained; this work is now being done.

The accompanying table shows the principal points relative to each plantation already visited. Figures of all the sample plots are on file in the State Forester's office for public reference.

Plantations Investigated.

1. American Eucalyptus Company.

2. California Eucalyptus Timber Company Tract No. 2.

3. Eucalyptus Estates Company.

4. Eucalyptus Culture Company.

5. Forest Syndicate.

6. Forward Movement Syndicate.

7. Golden State Eucalyptus Company.

8. McCully Eucalyptus Syndicate. 9. Murrieta Eucalyptus Company.

10. North American Hardwood Timber Company.

11. Pratt Eucalyptus Company.

12. Sacramento Valley Timber and Land Company.

13. Sacramento Valley Eucalyptus Company.

- 14. Sacramento Valley Improvement Company.
- 15. Southwestern Cooperative Land Company.

16. United States Timber Company.

17. Yolo Eucalyptus Company.

18. Yolo Hardwood Company.

Plantations Not Investigated.

1. American Eucalyptus Company Tract No. 2, Banning, Riverside County.

2. California Eucalyptus Timber Company Tract No. 1. Tulare.

Tulare County.

3. California Home Extension Association Tract No. 1, Wasco, Kern County.

4. California Home Extension Association Tract No. 2, Soledad, Monterey County.

5. California Home Extension Association Tract No. 3. Mountain Colony, Kern County.

6. Calimex Plantation Company, Bromela, San Luis Obispo

7. Consolidated Eucalyptus Company, Fresno, Fresno County.

8. Eucalyptus Timber Corporation, Pixley, Tulare County.

9. Forest Corporation, Chittenden Station, San Benito County.

10. Fresno Eucalyptus and Land Company, Fresno, Fresno County.

11. Golden State Realty Company, Orange, Orange County.

12. International Eucalyptus Plantation Company, Westfield, Kern County.

13. Los Berros Forest Company, Callender, San Luis Obispo County.

14. Yucaipa Water and Lumber Company, Redlands, San Bernardino County.

SUMMER HOMES ON THE NATIONAL FORESTS.*

An act of congress of March 4, 1915, authorized the Secretary of Agriculture, upon such terms as he might deem proper, to allow the occupancy of lands within the national forests for fixed periods not to exceed thirty years, for summer homes, permanent camps, hotels, resorts, stores, and other structures needed for recreation or public convenience. Before this act was passed, forest lands had been leased for all sorts of special uses, including the above, under permits subject to revocation at any time. The passage of this act greatly stimulated what federal officials term the "summer home business" during the past year.

It is the recreation use of the forest lands that this act is designed to stimulate, and it is this purpose rather than the raising of revenue that fixes the rental charges, which range from \$10 to \$25 per annum for residence sites, and from \$25 to \$250 per annum for resort sites. Charges for lands used for other commercial purposes in connection with the recreation use are based upon a fair estimate of what rent

these same lands would bring under private ownership.

The increased demand for these sites resulted in the forest service making a special survey and staking out large lots in several of the forests during the past year. Tracts were laid out in the canyons of the Angeles, Cleveland and Santa Barbara forests and sites were staked along Feather River Canyon and in the Gold Lake region of the Plumas Forest, and about Rush Creek, Gull Lake and Silver Lake on the Mono; along the South Fork of the Trinity River on the Trinity Forest, and near Lower Strawberry Lake on the Stanislaus. In addition to these surveyed sites, the supervisors of practically all the other forests in the state have platted building sites in especially attractive regions, the most noteworthy of which are perhaps the Lake Tahoe region on the Tahoe Forest and Fallen Leaf and Echo Lake regions on the El Dorado; Huntington Lake on the Sierra, and the Medicine Lake region on the Shasta.

It should be remembered that these tracts are not laid out indiscriminately in the forests, but are staked along the banks of streams or about the shores of lakes long recognized as desirable locations for camps. The plan followed in staking these lots takes into consideration the commercial uses of the forest, and it is not intended that tracts used for this purpose shall ever interfere with a government timber sale or the use of a needed reservoir site. In general, areas used for recreation purposes are chiefly valuable for that purpose.

Attention has been given to the needs of the transient camper. He is free to come and go where he pleases, but in certain regions, and particularly along the heavily traveled roads, public camp grounds with

many conveniences have been established for his use.

On the other hand the seeker of solitude is not compelled to choose a lot within the confines of a summer resort. He may stake out his own site in the heart of a forest miles from the nearest neighborhood. In the Angeles Forest, only, where the proximity of the city of Los Angeles and the consequent demand for summer home sites with the limited

^{*}Article supplied by Mr. Coert DuBois, District Forester, San Francisco.



Los Angeles Municipal Playground, located on the Angeles National Forest.

areas suitable for this purpose has anything like an ordinary summer resort come about. Here in the hidden canyons a few hours ride from the city is a demand for every available lot.

The individual constructing a summer home or permanent camp within the national forests has a number of marked advantages over one who purchases in a tract developed by commercial bodies. In the first place no taxes are his to pay, nor is he ever assessable for road or trail work, or fire protection. The forest service constructs roads and trails for the use of campers as well as for its own administrative purposes. The value of the forest service fire protection is fully apparent to one who has spent a vacation in the height of the forest fire season in a recreation country outside the national forests.

In one case the government has piped water onto the lots. At Huntington Lake, in the Sierra National Forest, a water system, consisting of water mains and tank, has been constructed by the forest service without cost to the residents. For full measure the forest service will throw in plans for the construction of a simple summer home, with specifications for material and directions for building.

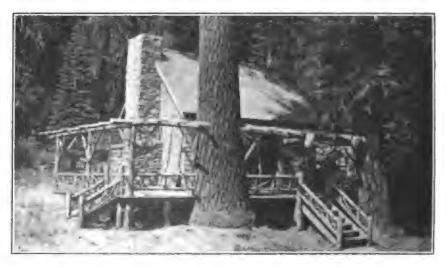
Residents of the forest can always secure timber at cost for building purposes, and, in many instances, it will be granted free. The fuel problem, too, is simple. It can be gathered from the dead wood in the surrounding forest.

Perhaps the greatest advantage to the seeker of a forest home is the fact that with due allowance for timber sales and the construction of water power projects he may build his home secure in the belief that the surrounding forest is forever free from spoliation. The wilds are his and will not be taken from him. Fishing and hunting are allowed subject to the state game laws, and game is afforded protection by the forest officers, who are in many cases deputy state game wardens.

On the part of the renter little is demanded. There is absolutely no red tape. The permittee may choose the lot from a map, or on the grounds himself in company with a forest officer, pay the rent for one year and take possession at once. The regulations he is asked to observe are chiefly those dealing with sanitation, and are no more than would be imposed in any decently restricted residence tract. The adequate disposal of sewage is demanded, and, in order that no unsightly structures may disfigure the forest landscape, the renter's building plans must bear the approval of the forest supervisor.

That these advantages are recognized by the public is evidenced by the constantly increasing demand for building sites. Already the Angeles Forest has rented more tracts for building purposes than all the national forests in the country together. About eight hundred permits have been taken out for the construction of schools, clubhouses, hotels, resorts and residences. For several years past the city of Los Angeles has maintained a municipal camp ground at Seeley Flats on 21 acres rented from the government. Here hundreds of children and their parents are given two weeks vacation annually at cost. On the Sierra Forest at Huntington Lake the Fresno State Normal School has established summer headquarters by constructing assembly halls, laboratories, dining hall and cottages. Here a six weeks course each summer is to be given with particular attention paid to nature study.

Fallen Leaf Lake, in the El Dorado Forest, is rapidly becoming encircled with summer homes on government land, and the recent survey of a splendid tract at Carnelian Bay, Lake Tahoe, has resulted in a demand for building lots. Lots in the Gold Lake region of the Plumas and in the Feather River Canyon have been in demand, some homes have been constructed on the Shasta and on the Santa Barbara. All of the eighteen forests have areas well adapted to this use, and lots may be had in each by making application to the supervisor of the forest, any officer on the forest, or to the District Forester, 114 Sansome street, San Francisco.



A summer home along the Lincoln Highway, Placerville to Lake Tahoe, on the Eldorado National Forest.

This use of forest lands is in line with the permanent development of the national forests. The recreational use of these forests is to be furthered with every possible effort. Approximately ninety thousand maps of the national forests in California were printed and distributed during the past year to campers and travelers. Hundreds of acres of grazing lands have been set aside for the use of the campers' stock. Trails and roads opening up the scenic regions have been constructed and an attempt has been made on the part of the forest personnel to afford every possible aid to the recreation seeker.

LEGISLATION.

Popular need generally expresses itself in some appropriate legal enactment which will provide a means for supplying the necessary reform or improvement. Unfortunately, one great exception to this has been the life of forest legislation in California. There is every need, there has long been every need, in the state for a clear cut and definite policy of forest protection and management. The need is simple and unquestioned; the avenue to be followed leading to successful state-wide protection and helpful accomplishment in many features of forestry has

frequently been pointed out; but, so far, California has not succeeded in possessing a forestry bill which will permit the operation of real good forestry work.

Be the reason this or that—all prejudices of the past from all angles will soon yield to the common demand. We have got to work the thing out, all hands helping, and it is this spirit which invites farsighted

legislation at this time.

Under the present act the State Forestry Department can not employ fire-fighters; it can not enjoy the satisfaction of accomplishing what alone can be done by a force of paid firewardens and patrolmen—there is no legal provision for the compensation of either, and our worn-out system of voluntary firewardens is a system merely by courtesy and a thoroughly proved failure by experience. The State Forester's hands are tied when it comes to helping communities further than to offer suggestions and tell what should be done. We have got to have a chance to say—"These are our suggestions—the plans we advise. We will start things; we will do a third—a half—all, if an emergency, and you get busy and do your share!" When the State Forester can offer such help to rural communities no one can justly criticize the work of the Forestry Department.

A forest protection bill is an actual need in California. If it makes unquestionable provision for the following points it will be a progressive step in the great scheme of practical conservation and will speedily

prove its worth.

First—A definite authority for the organization of a system of state paid firewardens and patrolmen.

Second-Ample provision to enable the State Forester to hire and

pay fire-fighters, and to organize fire preventive measures.

Third—A clear cut and practical provision for cooperation between state, county, municipal and private agencies.

A forest protection measure failing to give full scope in any of these three phases will embarrass the development that should be made.

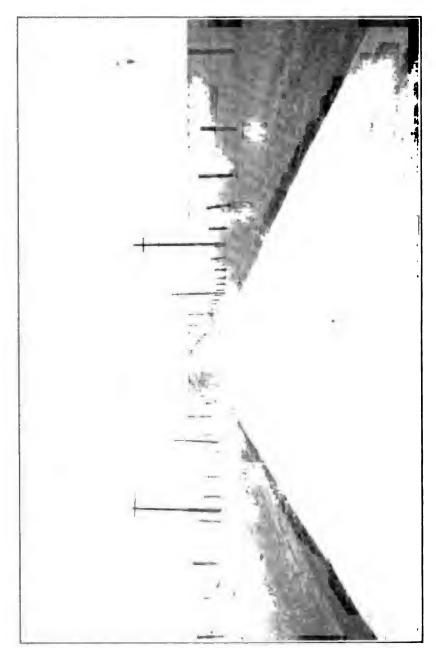
Amendment to Citizen Employment Act.

In 1901 an act was passed to secure to naturalized citizens of the United States the exclusive right of employment in any department of state, county, city and county, or city governments in this state. In 1915 the act was amended to exempt from its original requirement instructors in public schools, since many of the only teachers available for certain studies were not citizens of the United States.

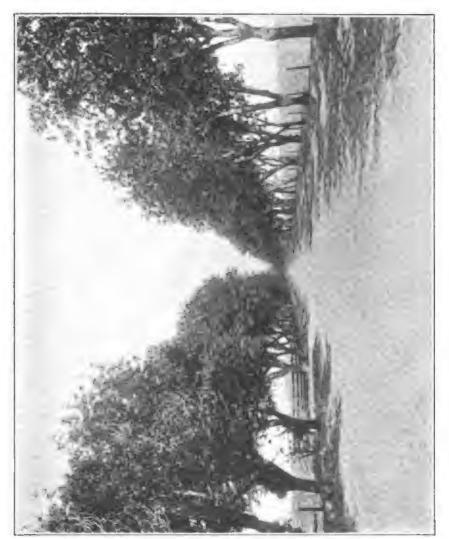
In order to bring a forest fire under control it is frequently necessary to secure every available man in a community, and it is no time to raise the question of citizenship. It is strongly recommended by this department that the act be amended so as to further exempt persons hired in case of actual emergency where it is necessary to protect life, health or property.

State Forest Nursery.

Few phases of public improvement are commanding more attention than our roads and highways. A state can justly be proud of its good roads, and California, recognizing the value of such improvement, is rapidly increasing her mileage of well constructed highways.



This is characteristic of much of the newly constructed state highway throughout the broad valleys of California. Not a free in sight for miles; an excellent opportunity for highway planting. Many ornamental varieties will grow readily in the various kinds of soil. A state nursery could supply abundant stock for such planting and splendid cooperation between the Slate Forester and the Highway Commission can be established.



A stretch of road in the Sacramento Valley ornamented with black walnut trees.

A great many miles of highway are now without trees; one is forced to drive for miles, through sections of the state, along a glistening highway with no shade of any kind, and during the summer months especially is this lack of highway planting felt. There are in addition to the state highways numerous county roads along which planting should be done.

It is recommended that a state forest nursery be established under the immediate direction of the State Board of Forestry, the same to be located in a central place easily accessible from all parts of the state. In addition to supplying trees for roadside planting throughout California, this nursery will be able to grow ornamental trees for the various state institutions and forest stock for landowners who can not secure such material in the commercial nurseries.

There are innumerable requests received by the State Forester for material and information which could be supplied if the department had an experimental area and nursery. Perhaps no other phase of state forest work will reach in a helpful way more people than a forest nursery. There has long been a live need of such a feature in the work of the Forestry Department, and every possible effort will be made to succeed in making it a reality.

Plans have been made whereby splendid cooperation can be established between the Forestry Department and the Highway Commission in growing and supplying, and planting and caring for trees for highway beautification. There has been a need for a well operated and complete state nursery in California.

In view of establishing such a nursery the sum of \$28,000 has been submitted as the biennial estimate for its construction and operation. The nursery should be located, if possible, on land already owned by the state.

With such a state nursery the State Forester will be able to render great assistance to county tree planting organizations.

At present, under the direction of the State Board of Forestry, there is being prepared a complete and exhaustive bulletin dealing with all of the well established ornamental trees of the state, including those of foreign origin. Tables will show for each county the suitable trees for various purposes, and a full page picture of every species besides the descriptive text will be included in the bulletin. This bulletin will be of great value to California ornamental tree planters, and will be for free distribution. It is the result of repeated letters of inquiry which the State Forester has received relative to roadside and park planting.

It is the purpose of the State Forester to give several illustrated lectures on highway planting in various parts of the state. Material for these lectures is now being obtained.

The bulletin on ornamental trees will more than supplement the "Street and Highway Planting" bulletin recently published by this department, and which is almost out of print—having been generally useful and widely requested.



There is no substitute for good highway planting. Eucalyptus species are quite generally used, and there are a great many other very beautiful species suitable for roadside planting.

APPROPRIATIONS AND EXPENDITURES.

The appropriation to carry on the work of the Department of Forestry for the sixty-seventh and sixty-eighth fiscal years (July 1, 1915, to July 1, 1917) was \$45,800, divided as follows:

Salaries		\$12,800 00
State Forester	\$6,000 0 0	, , , , , , ,
Deputy State Forester	. 3,600 00	
Assistant State Forester	. 3,200 00	
•	\$12,800 00	
For support of the State Board of Forestry, including field a	_	
expenses For printing, binding and stationery		
For printing, binding and stationery		6,000 00
The expenditures under this appropriation were s	s follows:	
Salary State Forester	\$3,940 00	
Salary Deputy State Forester	1,901 89	
Salary Assistant State Forester		
	\$7,975 09	
Balance in salary fund, November 1, 1916		\$4,824 91
Equipment, supplies and miscellaneous	\$1,510 42	
Fire fighting		
Field and educational work; including meetings attended	•	
lectures delivered and forest and fire investigations	. 3,622 55	
Postage	- 435 00	
Telephone, telegraph and express	. 266 79	
Stenography, typewriting, clerical and general office	9	
expense	. 4,002 90	
	\$10,354 67	
Balance in support fund, November 1, 1916		16,645 33
Fire warnings and notices	_ \$676 44	
Fire reports, bulletins, circulars	. 739 70	
Stationery and binding	443 38	
	\$1,859 52	
Balance in printing fund, November 1, 1916		4,140 48

1917 REPORT

by the Manager of the

Fruit Growers Supply Company

Year Ending August 31st, 1917

A. M. Mortensen, Manager



GENERAL CONDITIONS AFFECTING OPERATIONS

The function of the Supply Company is that of purchasing general supplies for its members for use in their packing houses and orchards. All members are stockholders in the organization and all savings, less only the actual cost of handling business, are given back to its members either at the time purchases are made or in the annual refund which is made at the end of each fiscal year. General market conditions during the past year have been very unsettled, and still continue so. All markets are now sellers' markets, and in many cases our greatest problem is securing of supplies, rather than the matter of a satisfactory price. Notwithstanding the chaotic condition of the market and the higher prices we have been compelled to pay for supplies, the margin of savings to members has been maintained.

The advantage of the Supply Company as a central purchasing and distributing agency for our growers has been amply proven the past season. Having the support of so large a number of growers the Company has been able to arrange for necessary supplies in large volume and to make distribution to our members on an equitable basis, so that no serious loss has occurred on account of inability of Associations to secure supplies for packing and shipping their fruit, which would unquestionably have been the case had each Association been obliged to arrange for its supplies direct.

Co-operative purchase and distribution of box shook during this season of serious shortage of material has resulted in a fairly equitable division of such supplies as have been received, based on the comparative crop holdings of our different members. It would have been impossible to secure this result under any other method of handling.

BUSINESS TRANSACTED

From September 1, 1916, to August 31, 1917, the total amount of supplies handled by the Supply Company represented a value of \$5,759,080.53, segregated as follows:

Packing House supplies	\$3,189.592.46	
Orchard supplies	1,530,350.86	•
Other items handled without profit	56,137.21	
Hilt sales of lumber and lumber products	816,876.00	
Company store and commissary sales, including rentals and revenues from ranch lands		

Compared with the figures of last year, the total business handled shows an increase of approximately \$1.660,000.00, or forty-one per cent.

OPERATING COSTS

The total expense of handling business through the Los Angeles office, exclusive of Hilt business, was \$39.504.41; this represents a cost of 82.713 cents for each \$100 of business handled, which is slightly lower than last year.

PACKING HOUSE SUPPLIES

Packing House supplies handled consisted of the following items:

	Value
Orange boxes, all kinds	\$1,574,498.25
Lemon boxes, all kinds	
Picking boxes, and lemon trays	
Repair parts and extras	111,559.82
Car strips	
Tissue wraps, printed	
Labels, including cost of special art work	43,712.95
Box curtains	
Nails	64,767.35
Miscellaneous material	193,726.93
Total Dealine House smaller	62.1

Total Packing House supplies......\$3,189,592.46

ORCHARD SUPPLIES

Orchard supplies furnished during the year are as follows:

	vaiue
Cover crop seed (Melilotus, vetch, cow peas, etc.)	\$ 84,900.51
Cyanide	
Sulphuric Acid	38,335.05
Commercial fertilizers	394,524,63
Stable manure	45,679,60
Spray equipment and supplies	
Frost prevention equipment and supplies	
Miscellaneous material	
•	

Total value Orchard supplies......\$1,530,350.86

ANNUAL REFUND

After paying all operating expenses there is an available surplus of \$163,225.19. Of this amount, following the usual custom, 10 per cent, or \$16,322.52, has been placed in the Reserve for Contingency Fund, and the balance, or \$146,902.67, will be refunded to the members. Refunds to members are made on the basis of their purchases. On Packing House supplies the amount of refund is \$87,620.84, or 2.747 per cent of purchases made. On Orchard supplies the refund is \$59,281.83, or 3.874 per cent of purchases made.

On March 28, 1917, the Board of Directors authorized a segregation of Orchard supplies into different classifications and directed that refund be based on the profit made in handling each classification. Our refund on Orchard supplies purchased during the first seven months of the fiscal year has been based on the total volume of business without reference to the different groups; whereas that on Orchard suppplies purchased during the last five months, or since April 1st, has been segregated as shown below:

Fumigation and spraying	4.3537%
Fertilizers	5.9240%
Cover Crop	11.7510%
Frost prevention	2.0636%
Automobile tires and accessories	4.9703%
Ranch implements and tools	12.0643%
All other Orchard supplies	5.4866%
Average for period April 1st to August 31, 1917	5.1602%

The refund on Orchard supplies for the entire year is as follows:

For 7 months ended March 31, 1917	2.7660%
For 5 months ended August 31, 1917	5.1602%
For entire season	3.8737%

This plan of segregating refund on Orchard supplies enables Associations to refund to growers the actual amount retained on various purchases under these classifications.

CONDITIONS AFFECTING SUPPLIES

BOX SHOOK

The decrease in refund on Packing House supplies is due to the falling off in the margin between the cost and our billing out price on box shook furnished our members. In former years it has been possible to purchase a considerable volume of shook at prices lower than our contract prices from small manufacturers with whom we had no contracts. This year very little shook has been available from these sources, and such as we have been able to purchase to relieve our needs has been necessarily obtained at prices very much higher than our contract prices. There has been a shortage of box lumber over the entire Pacific Coast, due principally to the following causes:

- (1)—Weather conditions this spring, which delayed the beginning of logging operations from four to six weeks.
- (2)—A very serious shortage of labor in all departments of the lumber and box industry.
- (3)—A greatly increased demand for citrus shook, due to the heavy crop, and for shook of all other kinds, due to the unusual activity in food products.

In order to meet the requirements of our members it was necessary to arrange with local lumber companies and factories to equip themselves for making box shook. To secure these supplies we had in many cases to pay prices very much in excess of our regular billing out prices. In some instances high grade lumber was used, as it was impossible to secure sufficient box lumber. These conditions reduced our Packing House refund materially, but the extra cost of the shook has been equitably distributed among all members, with the result that the small Associations shipping only a few cars of fruit have been furnished with their shook supplies at the same price as large Associations and shippers who use very large quantities.

After allowing for the box shook proportion of the Los Angeles office operating costs and deducting from the box shook profits the ten per cent for our Reserve Fund, the net cost to our members on Standard No. 1 Orange boxes for the year will figure 13.14 cents per box at Los Angeles common points. The cost to members of all other kinds of citrus shook is on a corresponding basis. This applies to all box shook purchased on contract or in small lots, as well as those manufactured at our Hilt plant.

A new contract has been entered into this year, covering a term of five years for four million boxes per year. We now have under contract with box companies and available from our own plant a maximum of sixteen million boxes annually. Our contracts all carry clauses releasing us from the obligation to take more than our requirements in the event of a reduction in crop by freezing or other unavoidable crop conditions. With the return of more nearly normal conditions in the lumber districts, our shook needs for the future will be provided for, and at prices that in normal times are fair both to the producers of shook and to ourselves. These large contracts are made on broad lines, with the idea of paying a price for supplies that will return the producers a fair profit and at the same time assure our members of their supplies, whether our crop is large or small, and take care of the constantly increasing proportion of the crop handled by the California Fruit Growers Exchange. To provide fifteen million boxes, as has been done this year, requires over seventy-five million feet of lumber, which is a very large percentage of all the box lumber produced in the State annually.

TISSUE WRAPS

Our contract for tissue wraps expired August 31, 1917, and early in the year negotiations for future supplies were opened with paper companies. War conditions and the labor shortage, together with practically a discontinuance of tissue pulp importations from which this paper is made, resulted in an increase of nearly 100 per cent in the open market price of paper from which fruit wraps are made. A thorough investigation of all possible sources of supplies was made and contracts finally arranged with the same companies that have furnished our paper for many years. These contracts were made at prices materially higher than those of previous contracts but much lower than the present general market prices.

Members of the Supply Company have this year used more than 4,000 tons of tissue wraps in wrapping their citrus fruits. With this very large volume it was absolutely necessary to make direct connections with mills having the capacity necessary to protect our needs. Our increase in prices represents the increase in cost of labor and supplies used in producing this product.

Printing.—The matter of the Supply Company establishing its own plant for the purpose of printing tissue wraps was fully investigated. In view of the unsettled conditions, making it difficult to secure at reasonable prices the necessary equipment, and the further fact that negotiations with the paper companies resulted in a material reduction in the price of printing over former years, it was decided that the establishment of our own printing plant should at least be deferred until conditions became more settled. Under our present arrangement with paper companies the printing will be done practically at cost. These printing contracts run concurrently with our contracts for paper, we, however, having the option of terminating them at the end of any season.

NAILS

We were fortunate in making a contract for nails and our orders for next year's entire supply of 26,000 kegs have been accepted at a price that effected a saving to our members of at least \$1.00 per keg, compared with the present market price. Our nails are manufactured by one concern, from whom we make direct purchases. The manufacturer is working very closely with us in trying to produce a nail that will exactly meet the requirements of our members.

CYANIDE

Notwithstanding the unusual demands for this material and the resulting shortage, due to the war, we were able to secure from the manufacturers enough cyanide to meet the requirements of our members at prices only slightly higher than we have paid in previous years; and far under the general market price of this commodity. The manufacturers, instead of making the general market price the governing factor in fixing our price, added to our former price the additional cost to them, due to advances in the cost of labor and materials. They are spending large sums of money annually in investigating new manufacturing processes that may eventually reduce the cost of the product to us.

SULPHURIC ACID

Conditions similar to those surrounding the demand for cyanide affect the demand for sulphuric acid. The manufacturers with whom we have contract have taken care of our needs on broad lines entirely fair to us. This policy has enabled us this year to fill the requirements of our members at prices somewhat less than last year, although the open market price was considerably higher.

COVER CROP SEED

While we have been able during the past season to secure a good supply of Melilotus seed at favorable prices, the indications are that there will be a very

serious shortage of this seed next year. Anticipating the needs of its members, the Supply Company is arranging for a considerable acreage in the northern part of the State to be planted under a plan that will give us control of the entire output.

The Supply Company delivered to its members this year their entire requirements of vetch, cow peas and other cover crop seeds, and is arranging for a sufficient quantity to take care of their demands for next year.

COMMERCIAL FERTILIZERS

The fertilizer business of the Supply Company is showing a satisfactory increase. Many Associations are now equipped to store carloads of fertilizer for distribution among their members in less than carload lots. The Supply Company is a licensed fertilizer dealer under the California State laws, and has the full coperation of the State University in the inspection and analysis of the various fertilizers handled.

Reports from the east indicate a general shortage of all kinds of fertilizers, and it is exceedingly difficult to obtain adequate supplies. The Supply Company is fortunate in having a large tonnage under contract for delivery during the coming year, and its members' requirements will be fully protected, so far as can be anticipated at this time.

BARNYARD MANURE

In past years the quality of manure furnished has been gradually deteriorating, as many shippers were making it a practice to add weight and volume by the addition of water and soil. It seemed impossible to overcome this condition under past methods of handling, and the Supply Company therefore early this year made arrangements to secure supplies direct from companies and individuals owning animals. Competent inspectors were secured and cars inspected as loaded, thus guaranteeing supplies that have not been adulterated by the addition of water and dirt. Our business in this product has doubled since 1916 and this year amounted to 1110 carloads.

BUD SELECTION

Probably no factor in the success of an orchardist and the future of the industry is as important as the yield per acre, and no factor in the yield per acre is more important than the type of trees in the orchard. While the truth of this is recognized by most growers, there has not in the past been any commercial source of bud wood that would insure the securing of trees of the highest type. Recognizing these conditions, our Board early in May of this year, authorized the management to arrange for dependable sources of bud supplies and to furnish these supplies to growers. Arrangements have already been completed with growers owning particularly good groves in the various producing districts to keep individual tree records so that the very best trees in these higher type groves can be unmistakably located.

The Supply Company will cut bud wood from these trees and furnish it to members at cost. Fortunately, some growers owning good orchards have been keeping tree records for several years past and we were thus able to supply buds this year from record trees. Since the establishment of this work over 40.000 buds have been cut and delivered, and we now have on our books firm orders for 60,000 more to be delivered early next spring. These early orders for a large number of buds indicate an appreciation of the importance of this new step and a genuine demand on the part of growers for the continuance of this work.

HILT TIMBER TRACT AND MANUFACTURING PLANTS

The deeded properties of the Fruit Growers Supply Company, located near Hilt, in Siskiyou County, California, and in Jackson County, Oregon, consist of 22,737 acres that have now been actually paid for and free from all encumberances. These include about 2,000 acres in stock and ranch lands, and 300 acres on which the mill and townsite are located.

In the town of Hilt, which is on the main line of the Southern Pacific Railroad, two miles south of the Oregon line and 400 miles north of San Francisco, are located the saw mill, with an average daily ten-hour capacity of 120,000 feet, and the box factory, with a daily ten-hour capacity of 90,000 feet. Contiguous to the saw mill and factory are the lumber yards, with a storage capacity of 18,000,000 feet. The residential part of the town of Hilt consists of 99 cottages, which are rented to employes at moderate rates; the Company's store and office, hotel, hospital, employes' club house and the public school. The net value of the Hilt properties, after deducting current liabilities, is as follows:

The two ranches, ranch tools and live stock	cottages for employes, stock of lumber and box shook\$	580,245.00
Uncut timber on deeded lands, 265,410,000 ft. at \$2 per M	The two ranches, ranch tools and live stock	52,477.00
Timber and timber lands at Sims, California—640 acres	Timber lands cut over and uncut, valued at \$1.00 per A	20,383.00
Twenty miles of standard guage railroad	Uncut timber on deeded lands, 265,410,000 ft. at \$2 per M	530,820.00
	Timber and timber lands at Sims, California—640 acres	5,000.00
Pailroad rolling stock 75 900 00	Twenty miles of standard guage railroad	279,736.00
Namoau Torring Stock	Railroad rolling stock	75,800.00
13 donkey engines, logging tools and equipment	13 donkey engines, logging tools and equipment	66,100.00

Total value Hilt prpoerties as of December 1, 1916.....\$1,610,561.00

Since purchasing this property in 1910 the plant as now existing has either been built entirely new, or has been rebuilt, so that at present the Company owns a modern lumber manufacturing plant and box factory served by a modern standard guage railroad and all necessary logging equipment for the operation of the property. There are also ample facilities for housing and caring for its employes and their families.

The operation of the saw mill and factory was begun in the spring of 1911, and the records of the yearly cut of the saw mill and the cost per thousand feet is as follows:

Year	Amount cut	Cost in Pile per M ft.	
1911	15,330,000 ft.	\$11.42	
1912	12,380,000	11.31	
1913	15,775,000	11.26	
1914	24,160,000	10.27	
1915	26,271,000	10.27	
1916	25,058,000	10.07	
1917	24,000,000	10.60 (est.)	

The figures showing the cost of lumber in pile include the cost of falling the trees, hauling and loading logs on cars, transporting over railroad to saw mill, sawing into lumber, transferring into the storage yards and piling, together with all supplies and overhead charges, except value of stumpage, interest on daily balance, and the Los Angeles office expense chargeable against the Hilt operation.

Box Factory.—The box factory manufactures not only citrus boxes but all kinds of box shook usually manufactured by California lumber mills. This is necessary, as the entire plank will not cut into one kind of box to advantage, and to have an economical operation it is necessary to manufacture different kinds of boxes, using material of varying length, width and thickness, as well as quality. About 3,000,000 citrus boxes were manufactured this year at Hilt from our own lumber and from box lumber purchased from nearby mills. Our box factory, like the saw mill, is operated ten hours daily. By increasing our log cut, operating the mill and factory with two shifts and running twenty hours daily, the output of the factory could readily be increased by two or three million boxes per year.

General Considerations.—The 1917 saw mill cut will be approximately twenty-four million feet, and notwithstanding the fact that we had a late start, owing to weather conditions, and that we have been facing an increased cost of labor and supplies, and a serious shortage of labor, the general results promise to be better than those of any previous year. This is due almost entirely to the higher prices received for the lumber of better than box grade, which we sell in the open market.

In the operation of the Hilt plant at its maximum ten-hour capacity approximately 400 men are employed; these are divided as follows:

Office and store	10
Saw mill	40
Yard	50
Factory	65
Machine shop and foundry	
Train crews	10
Section crews	20
Railway construction	50
Woods crews	140

During the winter months, that is from December 1st to March 1st, when on account of snow in the mountains logging operations cease and the saw mill closes, the number of men employed will average 125.

The timber and deeded lands of the Company and those under contract insure the continued operation of our plant, on the present ten-hour basis, for the next fourteen or fifteen years. There are approximately 75,000,000 feet of privately owned timber in small lots contiguous to our holdings, which will be purchased as reached in our logging operation, and beyond our properties and tributary to our work and plant facilities there are some 350,000,000 feet of timber in the United States Forest Reserve owned by the United States Government.

If the present general shortage of box shook continues, the Supply Company can, with nominal expense, change to a double shift operation, thus increasing the cut at least 75 per cent and making available from our own factory, as previously stated in this report, from two to three million more citrus boxes annually. The advisability of so increasing our capacity is now being given careful consideration by the Board of Directors and the management.

UNIVERSITY OF CALIFORNIA COLLEGE OF AGRICULTURE BERKELEY

AGRICULTURAL EXPERIMENT STATION
SENJ. IDE WHEELER, PRESIDENT
THOMAS FORSYTH HUNT, DEAN AND DIRECTOR
H. E. VAN NORMAN, VIGE-DIRECTOR AND DEAN

CIRCULAR No. 178
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THE PACKING OF APPLES IN CALIFORNIA

By WARREN P. TUFTS

INTRODUCTION

Apples well graded and attractively packed will sell at a profit when others of similar quality but poorly displayed may fail to



Small display of packed apples put up by students of the University Farm School after twelve hours of practice.

attract the attention of the buyer. With 23,000 acres of young apple trees coming into bearing and with 40,000 acres at present producing in California, the grower will very soon be confronted by a 50 per cent increase in the state's apple production. The problem of the disposal of this crop is further complicated by the fact that unlike the orange, peach, and prune (which in point of acreage are the only

¹ Monthly Bulletin of the State Commission of Horticulture of California, vol. VI, no. 7, June, 1917.

tree fruits surpassing the apple in California), the apple is universally grown and must meet competition from all sections of the United States. In order, therefore, to market the California apple successfully, the highest standards of grade and pack must be attained.

According to the United States Census figures for 1910, apples from the Pacific northwest of the previous year sold for 40 cents more per box than did those from California. It is well known that the northwestern states began more than a decade ago to concentrate on a high-class grade and pack for their fruit. The same was true of some of the other states to the eastward while the majority of the California growers allowed themselves to fall behind in this regard. However, it is not too late to improve on these conditions and the recent state legislation is a step in the right direction.²

During past seasons many California apples have been profitably disposed of in European markets and there is no reason to doubt that in the future first-class fruit carefully handled will continue to find a ready sale provided the grade and pack compare favorably with the best from other sections. The best fruit only should be carefully graded and packed. Throwing on the market second-grade produce of any kind tends to lower the price of the fancy grades and for this reason alone fruit growers should refrain from glutting the market with poor stock. Furthermore, the present prevailing high prices for dried apples and acetic acid should induce the orchardist to dispose of his second and third-grade apples to fruit evaporators and vinegar factorics and pack only his first-grade or fancy fruit.

Due to the comparatively short period of consumption of summer apples it is often unprofitable to pack such varieties as the Yellow Transparent, Tetofsky, and Red Astrachan. Also, it is a question if it would be profitable for California growers to pay the cost of packing, transportation and storage on varieties of poor quality, such as the Ben Davis. Varieties of high quality, however, like the Gravenstein, Winesap, Yellow Bellflower, and Yellow Newtown will undoubtedly pay for careful handling.

THE BOX FOR CALIFORNIA APPLES

Various boxes have at one time or another been employed in the packing of apples. Of recent years only two or three have been widely used, but as late as 1904 seven different sizes of apple boxes were to be found on the Seattle market. At the present time California has discarded all others in favor of the so-called "North-

² California Standard Apple Act of 1917. A copy of this law may be obtained upon request to the State Commission of Horticulture, Sacramento, California.

west Standard" apple box (fig. 1, b), the dimensions of which are $10\frac{1}{2} \times 11\frac{1}{2} \times 18$ inches, inside measurement, and the "California" or "Watsonville Standard" (fig. 1, a), $9\frac{3}{4} \times 11 \times 20\frac{1}{4}$ inches, inside measurement. Hereafter in this discussion, for the sake of brevity, the term "Standard" will always have reference to the "Northwest Standard" box, and the term "California" will refer to the "California" or "Watsonville Standard" box. It is expected that

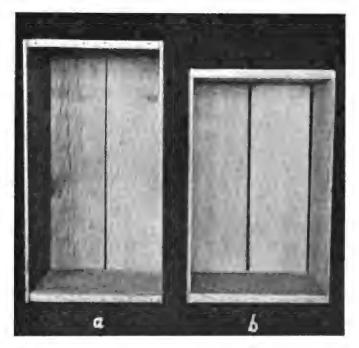


Fig. 1.—a, "California" apple box; b, "Standard" apple box.

the next season or two will see the general adoption of the "Standard" box in California as this is the package which is not only the most widely used throughout the United States, but also the one which is best adapted to the various sizes and shapes of all of our commercial varieties of apples.

Apple boxes come in the "knock-down" form and when ordering box material or "shook," as it is called by the trade, perhaps all the grower need specify is the type of box and its inside measurements. He, however, should insist on certain points. The ends and sides must each consist of one piece, the ends approximately 3/4 and the sides 3/8 inch in thickness. Tops and bottoms should be 1/4 inch thick and

1/4 inch longer than the sides. In the opinion of the writer, the following should be the dimensions of the "shook" for the "Standard" apple box, but in some localities difficulty may be experienced in securing such material.

STANDARD APPLE BOX

 $10\frac{1}{2} \times 11\frac{1}{2} \times 18$ in., inside measurement 2 pcs. ends $\frac{3}{4} \times 10\frac{1}{2} \times 11\frac{1}{2}$ in. 2 " sides $\frac{3}{8} \times 10\frac{1}{2} \times 19\frac{1}{2}$ in. 4 " T. & B. $\frac{1}{4} \times 5\frac{1}{4} \times 19\frac{3}{4}$ in. 4 " cleats $\frac{3}{8} \times \frac{3}{4} \times 11\frac{1}{2}$ in.

Use cement-coated, common 6d nails; 32 nails to box. There are 23,600-6d cement-coated nails in a keg.

THE HANDLING OF APPLES FOR PACKING

Since every step in the handling of fruit from the time it leaves the trees until it is sold has such a vital bearing upon the successful sale of the product, the leading co-operative fruit-growers organizations now regard the operations of picking, grading, packing, etc., as legitimate parts of the marketing process. After careful consideration of the matter the California Fruit-Growers' Exchange has decided that the "production" of the crop ceases when the fruit is ripe on the trees and that the agency that is ultimately to market the product should take charge of it at this point. The organizations were forced to take this position because the growers of citrus fruits failed to appreciate the necessity for handling their fruit with due care, thus vitiating the efforts of the marketing agencies to get satisfactory returns for the product. Apparently this view will shortly prevail among growers of apples, pears, and other deciduous fruits. Too much stress, therefore, cannot be laid upon the importance of proper harvesting methods.

There are two necessary considerations to be borne in mind when harvesting the apple crop; first, the *time* to pick, and second, *how* to pick.

Time to Pick.—The grower may be inclined to delay the picking of his apples beyond the proper stage of maturity in order that they may become larger in size or take on a better color. According to Whitehouse, there is a quite marked increase in the amount of color during the last few days before picking, and, consequently under certain association rulings where amount of color is considered, delay

⁸ Oregon Agricultural Experiment Station, Bulletin No. 134, June, 1916.



Fig. 2.—Two types of tripod ladders.

in picking various apple varieties may raise the fruit from a lower to a higher grade. There is also a gradual increase in size, but this merely follows the general growth ratio for the entire season, while in the case of color the rate of increase is much greater during the last week or ten days.

There may be likewise a tendency on the part of some growers to pick too soon in order to take advantage of the high prices often obtainable for certain varieties during the earlier part of the season.

Horticultural Commissioner W. H. Volck states:

Growers can approximately determine the maturity of apples by the iodine test for starch. When the core areas show general reduction in starch, and small portions of these areas do not stain blue (when treated with a dilute iodine solution), the variety is ready to begin harvesting. This is especially true if the fruit is intended for distant shipment or storage. Fruit intended for immediate use may remain on the trees two or three weeks longer. Growers may also learn to use the hydrometer in making juice tests. Bellflowers and other early apples will test about 12 per cent total solids in the juice, and Newtowns and other late varieties, about 13 per cent when sufficiently mature to begin picking.

If the apples are to be consumed locally, it is perhaps better to allow the fruit to remain upon the trees somewhat longer than otherwise would be advisable in order that they may take on a better size, color, and a somewhat higher quality. The general rule to follow in determining when to harvest is to note the color of the seeds which, in case of most varieties, should be brown. Color of the fruit is taken by some growers as the deciding factor in determining when to pick, while others rely upon the falling of the fruit from the tree, or the ease with which the stem of the apple may be separated from the fruit-spur. In order to pick the fruit at the proper stage of maturity, the grower should learn the traits and characteristics of each variety he is handling; for example, the Gravenstein has a tendency to fall before ripening, the Jonathan at time of ripening. which hang too long are likely to be subject to core-rot, while the White Winter Pearmain may be left on the trees several weeks after most varieties have been picked. Summer apples should be picked somewhat green if intended for shipment, as they have a tendency to drop badly when ripe. It should be borne in mind that yellow and green colors may change for the better in an apple after picking. while the reds change very little, if at all. It costs more to pick over the trees twice, but this cost will generally be more than offset by

⁴ See article, "Balling Degree of Fruit Juices," by Professor W. V. Cruess in the *Monthly Bulletin* of the State Commission of Horticulture for August, 1916. This publication may be had, free of charge, upon application to the State Commission of Horticulture, Sacramento, California.



Fig. 3.—Pointed picking ladder.

the increase in color and size of the remaining fruits. In the final analysis, however, the grower must decide the proper time of picking for himself, considering the variety, season, soil, shipping distance, and similar factors.

How to Pick.—The apple should be harvested by hand. The soft parts of the hand should be used, care being taken to see that the pickers have finger nails clipped short, and that the individual fruits are not pinched by the fingers in removing them from the fruitspurs. Here again, a Lawver will withstand more careless handling than will such varieties as the Jonathan, Yellow Bellflower, and Ortley. The foreman of the picking gang will have made much progress toward the desired end, if he can impress upon each worker the idea that the fruit should be handled as carefully as eggs.

The apple is best removed from the fruit-spur by a simple bending or twisting in one direction with the thumb against the stem of the fruit at the junction of the stem and spur. Fruits should never be pulled or jerked straight away from the spur as this is likely to either pull out the stem entirely, or else cause a breaking of the skin at the insertion of the stem in the fruit. Under the present California law all stemless apples, except Gravensteins, go in the lower grades.

When selecting a picking receptacle it is well to remember that if the picker is allowed to use both hands fewer fruit spurs will be broken off, and in addition a much cleaner and quicker job of harvesting done.

The ease with which an apple may be picked depends very largely upon the variety and the stage of maturity. Unless care is taken in harvesting the apples produced on spurs, severe injury may be caused to the spurs themselves and inasmuch as these spurs are the fruiting machinery of the tree, and remain profitable for many years, it behooves the grower to exercise caution in the picking of his crop not to injure his prospects for the years to come. After a spur is once destroyed it is practically impossible to replace it on the old, strong wood which is best able mechanically to bear a heavy load of fruit.

Picking Receptacles.—There are several very satisfactory picking utensils on the market. Some growers prefer baskets of one kind or another, either with or without padding. Some use a plain, large, galvanized iron pail, padded or unpadded. One of the advantages claimed for the pail when used without padding is that the foreman can readily detect pickers doing careless work by the sound of the fruit as it is dropped into the bucket. Baskets and buckets are provided with hooks for hanging in the trees or on the ladders.

Apples should be carefully placed in the receptacle and never thrown or dropped. Probably the two most popular picking receptacles are the picking bag and the patented picking bucket with a bottom so arranged that the fruit may be emptied without bruising. The better types of picking bags are also provided with a patented emptying device for the bottoms, and a ring at the top to hold the mouth open. When selecting a picking bag or sack one should be sure that the



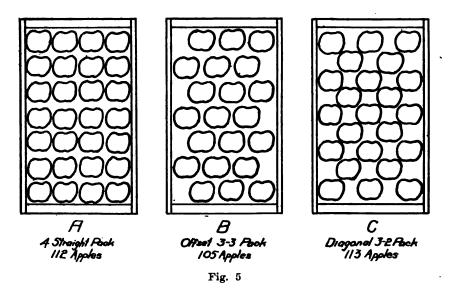
Fig. 4.—Picking bench.

sack will hang, when partially or wholly filled, so that it will be in no danger of coming between the workman and the ladder or main branches of the tree, thus causing severe bruises to the fruit. The picking bag or apron probably enables the fastest picking, but care must always be exercised to see that too much fruit is not placed in such a receptacle at one time, and that in one way or another all chances of bruising are avoided.

Lug-Boxes.—The orchard boxes or lug-boxes into which the fruit is emptied from the picking receptacle should be of fairly heavy material, wide enough to enable the basket, bucket, or bag to be lowered to the bottom for emptying, and preferably with ends raised

above the sides so that when filled with apples and piled one above the other there will be no danger of bruising the top layer of fruit. The ends also should have grooves cut into them to facilitate handling when filled. Lug-boxes should have a capacity of about one packed box of fruit.

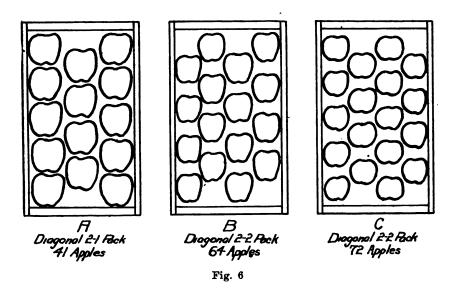
Ladders.—A well-constructed tripod or three-legged ladder (fig. 2) is by far the most satisfactory for general use. Such a ladder is more stable than a four-legged ladder under the rough conditions experienced in the average orchard and, furthermore, has the advantage of being so constructed that it may be set up in the midst of



an only moderately open-headed tree. There are many types of ladders in common use in the orchards of California, it being possible even to purchase a tripod ladder especially designed for side-hill work and so constructed that the steps are always horizontal, no matter how steep the hill or what the position of the ladder. Apple trees in California have not as yet reached the size attained in the East, where special long ladders have to be laid against the trees in order to reach the fruit, and, under our methods of pruning, probably never will. In the apple orchards of the state it is rarely necessary to place the ladder against the tree, and such practice should be avoided whenever possible on account of the danger of needlessly destroying fruit-spurs. The type of ladder shown in figure 3 is not placed in such a position that injury to the tree may occur and

on account of its lightness and strength can be strongly recommended for apple picking.

One of the best arrangements which the writer has observed is the use of a low bench standing approximately three feet high and broad enough to hold a lug-box (see fig. 4). The picker can place in the box thus held all fruit which he is able to pick from the ground and then, standing on this bench, can pick considerably more. Men with these benches are sent ahead of the main picking crew to remove all the fruit hanging low in the trees, thus saving a great many apples



from being knocked off and lost by teams hauling lug-boxes in and out of that section of the orchard.

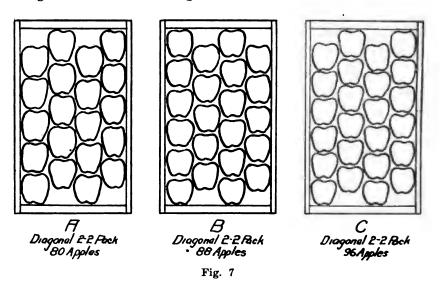
Hauling.—The truck used for hauling apples should be low for ease in loading and to enable its use under low-trained trees; it should also be easy riding to prevent any unnecessary bruising of the fruit.

GRADING

Grading is a classification of fruits according to size, color, shape and blemishes. "The Standard Apple Act of 1917" specifies that all apples sold in closed containers shall consist of one of three grades.⁵ To grade apples for the market involves two, more or less distinct operations, viz., sorting and sizing.

⁵ A copy of the text of this law should be in the hands of every grower.

Sorting.—From the very nature of the work sorting for color, shape, and blemishes of any kind must be done by hand, either at the time of picking or, as in the case of apples, in the packing house. The sorter should have explained to him very definitely, the exact limitations of the different grades and his work should be carefully supervised and frequently checked. The packer should likewise be impressed with the idea that no matter how conscientious the sorter may be, it remains with him to make the final selection and upon him in large measure depends the quality of the output. The fruit is brought from the field in lugs and is then sorted into 'California

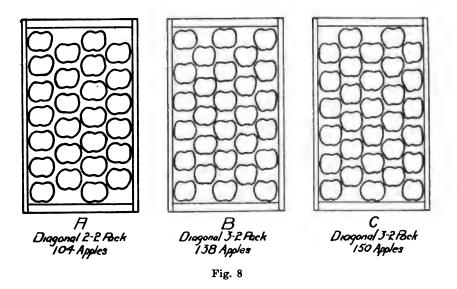


Fancy," "B," and "C" grades, and culls. At the present time the pack put up by many individuals in the state is really superior to that designated in the law as "California Fancy." And since the trade knows these brands, such packers have little or nothing to gain by labeling their best grade as "California Fancy." This new enactment will, however, go a long way toward raising the general standard of the California product and pack, and the growers in turn will inevitably profit.

Sizing.—After being sorted the apples are sized by machinery before going to the packers' table or sized by hand, either by the packer at the time of packing or separated into the various sizes by other workers before reaching the table. In most instances where the latter scheme is employed the apples are only roughly divided into three groups. In the Pajaro Valley the following divisions are

made: those fruits larger than 25% inches in diameter; those ranging from 25% down to 21/4 inches; and those smaller than 21/4 inches in diameter. With these groups before him it remains with the packer to do the final sizing.

On account of the relative shallowness of the "California" box, it is impracticable to use apples of the same diameter throughout the pack without having the top layer so high that it is almost impossible to put on the cover. The California law allows a variation of three-eighths of an inch in diameter between apples in the same box. In



a well-packed "Standard" box, however, the apples should not vary more than one-eighth of an inch in diameter.

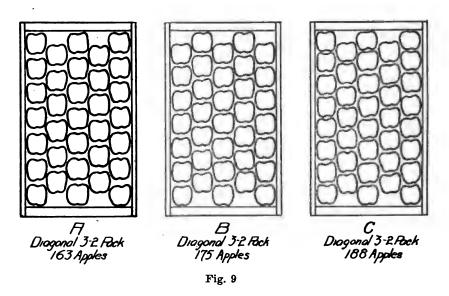
STYLES OF PACK

There are three styles of apple packs in use in California; the "square" or "straight" pack (fig. 5, a); the "offset" pack (fig. 5, b); and the "diagonal," "diamond," or "pear" pack (fig. 5, c).

The "straight" or "square" pack is employed for those apples which by reason of their size and shape can be placed check to check and just fill the width of the box without forcing and yet closely enough so that a sheet of paper cannot be inserted between fruits nor between fruit and box. The fruits in the second layer rest directly on top of those in the bottom layer and so on until the top is reached. It is readily seen when the lid is applied under pressure

that the only possible way to avoid crushing the fruit is to take care that the pack does not come above the level of the top of the box. As will be pointed out later, a bulge is absolutely necessary if the fruit is to carry well and therefore the packer is left only one other alternative and that is to choose some other style of pack.

The "off-set" pack until the last few years was quite widely used in certain apple-producing sections, but has been generally discarded on account of the relatively large empty spaces left in each layer; otherwise this pack is entirely satisfactory. Inasmuch as this style of pack has been widely experimented with for apples and as widely



discarded, there seems to be no good reason for its adoption by California growers.

The "diagonal" pack has proved, after extensive trial, to be the most thoroughly satisfactory in all respects. The apples in the second layer instead of resting on one point of contact with the fruit in the first layer have three points of contact. When the lid is put on and the pressure applied, the fruit, instead of bruising, is simply settled more firmly in the spaces left for this purpose.

Probably 75 per cent of the apples packed in this state during the season of 1916 were packed in the so-called "California" box. The pack in this box is generally designated as a "3-tier," "3½-tier," "4-tier," or "5-tier" pack. Unfortunately there is considerable confusion in the minds of many as to exactly what is meant



Fig. 10.—Progressive steps in the wrapping of an apple for box packing.

by the term "tier." The sense in which the term is here used means that when apples are of such a size that three of them will just fit, cheek to cheek, across the end of a box, such a size of fruit is called a "3-tier" apple. Likewise, when four apples, cheek to cheek, just fit across the end of the box, we have a "4-tier" size. All apples ranging in size between these two comprise what is technically known as a "3½-tier" size. It is evident, therefore, that a three or four-tier apple will be somewhat different in boxes of varying widths.

In determining the diameter or size of an apple it is invariably measured from check to check, rather than from stem to blossom-end. In California, apples smaller than 4½-tier are seldom packed. method of designating the size of the fruit contained in the box is at best clumsy as compared with the exact method employed by giving the actual count of the apples contained. Those growers who still use the term "tier" to designate size give as their reason that in this way they can dispose of their undesirable sizes by including them under the same pack with those most desired. Under this plan there may be as great a variation as fifty apples in a box, but all sell as 4½-tier apples. It is plain then why the street venders, hotel trade, and various other retailing agencies much prefer to buy apples knowing exactly how many fruits will be found in each box. especial importance to those who retail fruits by the dozen. That the trade would eventually give its preference to that fruit which comes to the market in "Standard" containers and plainly marked on the outside as to variety, grade, date of packing, and number in the box was wisely foreseen by those who drafted the "Standard Apple Act of 1917." This foresight is borne out by the fact that during the season of 1915 those growers of the Pajaro Valley who packed according to the provisions of the "Standard Apple Act of 1915" received approximately 15 cents more per box for their fruit, and also shows that the trade appreciated to a certain extent the more definite manner of designating the size, as well as the improvement upon the general method of sorting.

The list of apple packs given below is designed for the "Standard" box, the inside dimensions of which are $10\frac{1}{2} \times 11\frac{1}{2} \times 18$ inches. The same table may be employed in calculating the number of apples contained in the "California" box, although on account of the different shape it will be found impossible with certain sizes of some varieties to avoid the "square" pack as can be done with the "Standard" box. These two boxes are very nearly identical as to cubic contents.

APPLE PACKS

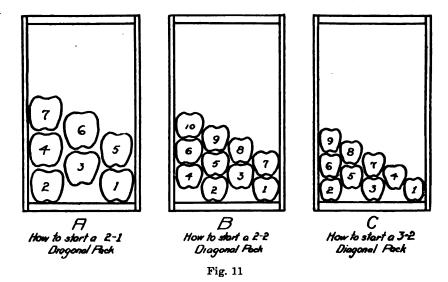
Number of fruits in box	Style of pack	Number of fruits in row	Layers deep
225	5 straight	9 long	5
200	5 "	8 ''	5
213	3×2 diagonal	$8 \times 9 \text{ long}$	5
200	3 × 2 "	8×8 ''	5
188	3 × 2 ''	7 × 8 ''	5
175	3 × 2 ''	7 × 7 "	5
163	3 × 2 ''	6 × 7 "	5
150	. 3 × 2 · · ·	6 × 6 ''	5
138	3×2 "	5 × 6 ''	5
125	3×2 "	5 × 5 "	5
113	3 × 2 "	4 × 5 "	5
120	2×2 "	7 × 8 "	4
112	2 × 2 "	7 × 7 "	4
104	2×2 "	6 × 7 "	4
96	2×2 "	6 × 6 ''	4
88	2×2 "	5 × 6 ''	4
80	2×2 "	5 × 5 ''	4
72	2 × 2 ''	4 × 5 ''	4
64	2 × 2 "	4 × 4 "	4
56	2×2	3 × 4 ''	4
48	2×2 "	3 × 3 ''	4
50	2 × 1 "	5 × 6 ''	3
45	2 × 1 "	5 × 5 ''	3
41	2 × 1 "	4 × 5 ''	3
36	2 × 1 "	4 × 4 "	3
32	2 × 1 "	3 × 4 "	3

Needless to say the sizes 32 to 56, inclusive, are more for exhibition purposes than for the general market. Packs 72 to 163, inclusive, contain the chief commercial sizes. The bottom layer of representative packs listed in the above table is illustrated in figures 6 to 9.

THE USE OF PAPER IN THE PACKED BOX

Lining Paper.—Paper, known to the trade as "white news," is used to keep out dust and odors. When starting to pack a box two sheets of this paper are placed in the box in such a way that they overlap on the bottom and are folded over the sides of the box during the process of packing. After the fruit is in place these ends are in turn folded over the finished top of the pack. It is well to give the lining paper an extra crease at the bottom so that when the pack is finished and the lid applied, the bulge, which is then distributed between the top and bottom, will not tear the lining along the bottom side.

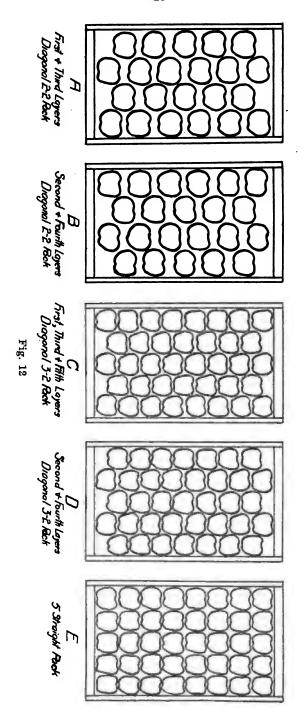
Layer Paper.—A light spongy cardboard or porous blotting paper is placed on the top and bottom of the packed fruit to absorb excess moisture. A sheet of this paper is put in the box as soon as the lining paper is in place, before starting the packing proper, and the second sheet is placed over the finished pack just prior to folding over the ends of the lining paper preparatory to nailing on the top. Layer paper was formerly used in some apple sections between each layer of fruit or between one or two layers, but this practice has been largely discontinued as it was found in most instances to be an



unnecessary precaution. For local shipment it is perhaps not necessary to use layer paper.

Wrapping Paper.—The paper which is placed around each individual fruit is one of the most important features in a successful pack. Dimensions of wrapping paper are given on page 21. The advantages of wrapping each fruit may be enumerated as follows:

- 1. Checks transpiration, thus reducing loss of weight.
- 2. Acts as a cushion, preventing bruises encountered both in packing and shipping.
- 3. Prevents the spread of decay by confining the disease to the one fruit.
- 4. Maintains the fruit at a more even temperature, thus prolonging its period of consumption.
- 5. Gives more finished appearance to the pack, especially if a small, attractive design is printed on each wrapper, which is in addition a good advertisement.



Few, if any, markets object to paper being used in packing and in most instances wrapped apples bring from 10 to 50 cents more per box. The paper used for wrapping purposes varies in quality from common "white news" up to the finer grades of tissue.

The beginner often raises the question as to the additional time required to pack wrapped apples. Experience has shown that after a few days' practice a man can wrap and pack faster than he can pack without wrapping. The actual time devoted to wrapping is but a fraction of the total time involved and, what is more important, the fruit stays "put," while if packed without wrapping the chances are more than even that when an apple is placed in the box, other apples will be moved from their proper places and thus much time be lost.

Figure 10 shows in some detail one of the methods used in wrapping. There are several very satisfactory "wraps" and every packer as he acquires skill generally devises some system of his own, although nearly all such short-cuts are modifications of one or two distinct "wraps." The method shown by the illustration is perhaps the simplest and when faithfully followed gives maximum speed.

Figure 10, a, shows the packer in the act of picking up the wrapping paper with his left hand, having at the same time picked an apple from the packing table with his right hand. Note the rubber fingerstall on the fore-finger of the left hand. By the use of this fingerstall the thin, single sheets of wrapping paper are easily picked Some packers use a rubber thumbstall, but the swinging or sweeping motion obtained by this little device when placed on the fore-finger gives the greatest speed. The apple is next tossed, stem up, into the paper held in the left hand and the right hand, with no lost motion, is brought into the position shown in figure 10, b. At no time during the wrapping process does the right hand grasp either the paper or the fruit, its function being merely to offer a rather solid working surface for the left hand. It should be mentioned that the paper is picked up by the thumb and fore-finger toward one corner and the apple, being tossed into the palm of the left hand, leaves more paper below than above the fruit. The next step is accomplished by continuing the upper movement of the right hand and the turning down of the palm of the left hand, as shown in figure 10, c. fourth step in the wrap is the twisting of the fruit with the left hand, the right hand being held firmly in place and at no time grasping the paper or fruit. See figure 10, d. Figure 10, e, shows the last step. namely, the left hand placing the wrapped fruit in the box after

having placed the fingers over the loose ends of the twist, and the right hand reaching for another apple.

The neatness of the pack, which materially influences the profitable disposal of the fruit, depends largely upon the care given to the wrapping of the individual apples and the placing of each in the box so that the ends of the wrapping paper are tucked out of sight. When properly wrapped and packed these loose ends act as a cushion for the fruit. The use of paper of proper dimensions for the various sizes of apples will also aid in securing neatness.

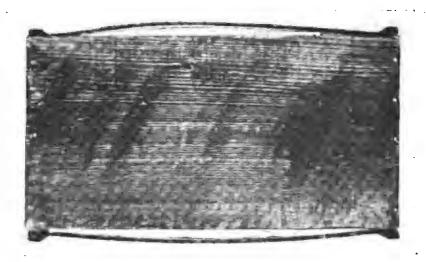


Fig. 13.—Packed box of apples showing proper bulge of both top and bottom.

Rules for Use of Paper:

Use 8 × 8 inch paper for 188 count and smaller.

9 × 9 '' '' 175 to 125 count, inclusive.

10 × 10 '' '' 112 to 80 count, inclusive.

12 × 12 '' '' 72 count and larger.

Layer paper, 11 × 171/2 inches for the Standard box, runs 14 to 15 sheets per pound.

Wrapping paper, 10 × 10 inches, runs 310-325 sheets to the pound. However, there is a variation in this weight due to the varying qualities of paper used.

DETAILED INSTRUCTIONS FOR PACKING A BOX

After having put in place the lining and layer paper the next step is to start the pack proper.

The 2×1 pack takes care of all apples larger than three across the end of the box. This pack should always be three layers deep. Figure 6, a, shows the first and third layers of this pack. Place an apple in either corner of the box and then continue as shown in figure 11, a, always placing the apple on its cheek, with stem directly away from the packer, keeping the spaces equal in size, watching the alignment, and finally ending so that the apples are held firmly in place by the pack. The second layer is packed in the spaces left by the



Fig. 14.—Showing a, too little bulge; b, proper bulge; c, too much bulge.

first layer and the third layer in turn is packed in the spaces left by the second layer.

The 2×2 pack takes care of all apples larger than four across the end of the box up to and including those just large enough to go three across the end. This pack should always be four layers deep. Figure 12, a, shows the first and third layers and figure 12, b, shows the second and fourth layers of this pack. Place an apple in the lower left-hand corner of the box and then one between this apple and the right-hand corner so that the spaces between the first apple and the second apple, and between the second apple and the right-hand corner of the box are the same. The next two apples are placed in the spaces thus left and then continue as shown in figure 11, b, always placing the apple on its cheek, with stem directly away from the packer, keeping the spaces equal in size, watching the alignment and finally ending so that the apples are held firmly in place by the pack. The second layer is packed in the spaces left by the first layer,

the third layer in the spaces of the second layer, and the fourth layer in the spaces of the third layer.

The 3×2 pack takes care of all apples larger than five across the end of the box up to and including those just large enough to go four across the end. This pack should always be five layers deep. Figure 12, c, shows the first, third, and fifth layers, and figure 12, d, shows the second and fourth layers of this pack. Three apples are first placed in the box, one at either corner and the third in the center. The next two apples are placed in the spaces thus left and then continue as shown in figure 11, c, always placing the apple on its



Fig. 15.—A type of mechanical sizer. Note sorting table at right with canvas drapers for carrying the fruits to the cups by which they are thrown into the various compartments. The lighter the apple the further it is thrown. The fruit is packed directly from these bins.

cheek, with stem directly away from the packer, keeping the spaces equal in size, watching the alignment and finally ending so that the apples are held firmly in place by the pack. The second layer is packed in the spaces left by the first layer, the third in the spaces of the second layer, the fourth in the spaces of the third layer, and the fifth in the spaces of the fourth layer.

The five-tier straight pack takes care of all those apples that are just large enough to pack five across the end of the box. This pack is always five layers deep. Figure 12, e, shows this pack in which all layers are the same. This is the only apple pack to be used when one apple rests squarely on top of another.

In those cases where three or four apples just fit across the end

of the box, the diagonal pack should be used. The fact that in the past many apples have been packed in the "California" box by the "square" or "straight" pack should have no influence in determining the style. A "straight" pack should be avoided whenever possible on account of the great amount of bruising caused by this system. Furthermore, the spaces left between the fruits are too large. It may be urged, in addition, that with the "California" box certain sizes and varieties cannot be packed unless a "straight" pack



Fig. 16.—Burlap or canvas top packing table.

is employed, but this is all the more reason for definitely adopting the "Standard" box, with which the markets of the world are most familiar and in which it is practicable to pack all varieties and sizes by the "diagonal" system.

It should further be stated that with certain sizes of some varieties it is necessary to pack the fruit either stem up or stem down rather than on the check, but when this is done care should be exercised to see that the stems are all turned in the same direction. The general rule should be to pack apples on the check whenever possible. Never allow the apples to slip sideways as this is likely to cause stempuncture and in addition spoils the alignment and causes the spaces

to be uneven in size. In order to secure the bulge of from ¾ of an inch to 1½ inches, counting both top and bottom, which is required on all box-packed apples, care must be exercised to so place the fruits that the height of the pack is built up faster in the center than at the ends of the box. This extra height of the apples in the center is attained by packing the fruit in the rows at either end so that the shortest diameter, as measured from cheek to cheek, comes directly up and down, the fruit being invariably placed on its side. After packing the first two rows next to the end of the box in this

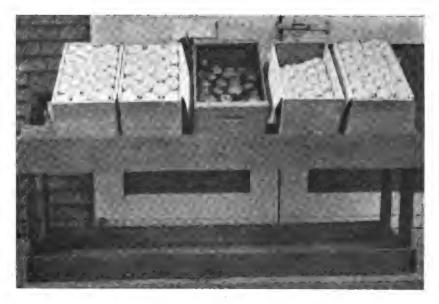


Fig. 17.—Table for packing fruit direct from the lug-box.

way, the apples should be turned so that the *longest* diameter from cheek to cheek will be up and down. As the farther end is reached the apples should again be placed with the short diameter up and down as at the other end of the box. If attention is paid to this detail in packing each layer, little trouble will be experienced in securing the proper bulge and the fruit will not be too high at the ends. For a "diagonal" pack the fruit should not be more than one-quarter or three-eighths of an inch above the ends. The looser the pack, the higher the fruit may be built up and no bruising result when the top is applied. The "square" pack must be held down to a quarter of an inch or less at the ends.

BOX PACKING PROBLEMS

When preparing apples for exhibit the packer is interested in knowing how his pack is to be scored and what points are to be considered by the judges in determining the best commercial box. Undoubtedly the following points would be considered and perhaps an equal value given each, as:

Bulge	20	points
Height at ends	20	• • •
Alignment	20	4.6
Firmness	20	"
Evenness	20	"
Total	100	"

Bulge.—As stated above, the total bulge should be at least three-fourths of an inch, but probably not more than an inch and a half, including both top and bottom. Preference is given to a box with a total bulge of about an inch to an inch and a quarter (see fig. 12). This bulge is extremely important in that it makes the package flexible and as the fruit shrinks in storage and shipment the slack is taken up and the pack remains firm. The method of obtaining the bulge has already been discussed. Figure 14 shows a pack having: a, too little bulge; b, a correct bulge; and c, too much bulge.

Height at Ends.—The method of obtaining correct height at the ends has perhaps already been discussed in sufficient detail. The beginner, however, will undoubtedly have considerable difficulty in securing the desired result unless extreme care is exercised. The packer should not be discouraged if the first few boxes have to be repacked three or four times before the fruit comes to the correct height. The proper bulge and height at ends should be striven for throughout all the layers and not left until the top layer is reached. When the pack invariably comes high it may be necessary to use cleats, such as are used in nailing on tops and bottoms to prevent splitting, in order to raise the height of the end of the box, but this should be done only rarely and cannot be recommended.

Alignment.—If the apples have been correctly sized and well packed, the fruit, as shown by the top layer, will line up vertically, horizontally and diagonally. This well-groomed appearance is an important factor in the profitable disposal of the fruit. Not only is proper alignment a great asset so far as appearance is concerned but, in addition, unless each layer is correctly aligned, it is almost impossible to complete the pack satisfactorily on account of difficulty

encountered in trying to secure fruits of varying sizes to fit the different sized spaces left. Naturally, it is not permissible to start the pack with one size of fruit and then shift to another. If it is found that there are not enough apples of the right diameter on the packing table to finish the box, it may be set aside and another size begun.

Firmness.—Firmness of arrangement in the box is of prime importance in a good commercial pack. The apple should be placed

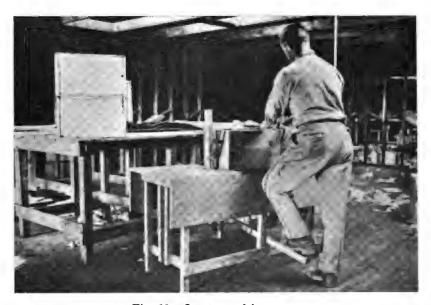


Fig. 18.—One type of box-press.

in the box in such a manner that the individual fruits cannot be moved by placing the hand upon a layer and exerting a firm pressure in all directions. The packer finds very often, when coming to the end of a layer, that his last row lacks $\frac{1}{8}$ or $\frac{1}{4}$ of an inch of reaching to the end of the box. The beginner is inclined to think this is close enough, but such is not the ease. Under such circumstances apples of somewhat longer diameter must be used either throughout the layer or, at least, in the last two or three rows. After making several unsuccessful attempts to use apples of somewhat longer diameter or different shape, it may be found that an incorrect pack is being used and some other style should be adopted for that particular variety and size. To give an idea as to the correct firmness, after packing the first layer, one should be able to turn the box on

its side without any of the fruit falling from place. On the other hand, the fruit must not be jammed or crowded into position, thus causing unnecessary bruising. After a box is packed, it should be possible to put a straight-edge along the side of the box and no bulge be noticeable. This particular point is important inasmuch as the packed boxes are always piled and shipped on the side and should there be any bulge in this direction bruising will take place. Unless firmly packed, apples upon shrinking in storage and shipment will become slack and in spite of the beneficial effects of the "bulge" together with the flexible top and bottom, some fruit will be bruised.

Evenness.—The box should be so packed that when the lid is put down over the fruit every apple in the top layer will be touched. There should be no low or high spots. It is extremely important that there be no bulge from side to side inasmuch as the top consists of two pieces and, being put on under pressure, should one side of the pack be higher than the other, the apples along the center are likely to be cut. The pack should be absolutely flat from side to side. Likewise if the lid does not touch certain of the fruits, these are likely to become loose and be bruised in handling. The greatest difficulty is caused by putting side by side fruits of differing diameters or, perhaps more accurately stated (because fruits are supposed to be accurately sized), turning one fruit with long diameter one way and placing the adjacent fruit on the short diameter side. Trouble from unevenness seems to be somewhat greater when fruit is packed with stems up or down than when packed on the check. convenience, an even pack is also very desirable from a commercial It has often been pointed out that the consumer purchases with his eyes; a good even pack makes a strong appeal to the prospective buver.

HANDLING FRUIT IN THE PACKING HOUSE

The packing house should be arranged in such a way that the fruit will pass, with the least amount of lost motion, through the various operations of unloading from the orchard wagon into temporary storage, sorting, sizing, packing, nailing, marking, labeling, and finally moving either directly into cold storage in connection with the packing house or hauling to a central storage plant to await sale or shipment. The individual grower must give considerable study to his particular needs and arrange his house accordingly. By a systematic arrangement of their packing houses some growers have been able to reduce the expense of handling from 2 to 8 cents per

box below their former costs. Only a few brief general statements can here be made.

The cheapest form of packing house and one that is considerably used, especially in the newer sections where but few crops have as yet been harvested, consists of a large tent. The use of a mechanical sizer makes the use of such a house make-shift feasible on account of the greater speed of the packers and consequently the less room needed for temporary storage. A good packer will put up 125 to 200 packed



Fig. 19.—Another type of box-press.

boxes a day when the fruit is sized for him, as against 50 to 75 boxes when he sizes the fruit himself. More permanent packing houses to accommodate an orchard of, say 40 acres, will cost from \$2000 to \$8000, according to the type of construction. Of course, cheap sheds can be constructed for less than this, but such a building has little advantage over a tent. A packing house should offer some protection to the fruit in the way of cool storage at least and to obtain this requires a good type of construction. Probably the community packing house and cold storage plant will prove to be the most satisfactory solution for the growers in many sections.

The most economical movement of fruit through the packing house is by gravity. Wherever possible, fruit should be handled by means of gravity carriers of which there are several satisfactory kinds on the market. As an instance of the saving effected by these carriers, the case of one packing house in Watsonville may be cited. After installing a gravity roller carrier about fifty feet in length, the output with the same number of packers was increased 200 boxes a day and the labor of four roust-abouts discontinued. With proper planning of the packing house, gravity carriers may profitably be installed in such places as from the unloading plat. I'm to temporary storage, from the storage room to the sorting table, from packing tables to nailing and marking bench, and from nailing bench to storage room.

The fruit as it comes from the temporary storage goes directly to the sorting table where it is graded, according to color, shape, and blemishes, into "California Fancy," "B," or "C" grades, and culls. Sorting is done at this stage whether the fruit is later sized by machine or hand. If sized by machine, two grades are generally accommodated at one time so that the sorted apples are placed directly on the sizing machine, the remaining grades being placed in boxes conveniently located to be run through the sizer on the second run. Packing tables holding one size only are a composite part of the modern sizing machine (fig. 15). These sizing machines formerly measured the diameter of the apple, but the present tendency is toward a machine which sizes the fruit according to weight.

Two types of packing tables are in common use where the sizing is done by the packer. Figure 16 shows a canvas or burlap-top table, four feet square and capable of holding about three boxes of apples. This table should be substantially constructed. Care should be taken to bevel the tops of the legs so no bruising of the fruit will take place. An extra piece of burlap fastened along one side is convenient for quickly cleaning the table of debris. The other type of table with top at an angle of 45 degrees, shown in figure 17, is designed to enable the packer to take the fruit directly from the lug-box as it comes from the sorter, thereby preventing any bruising which may be occasioned by rolling the apples on the canvas-top table mentioned above. shown in the illustration this system contemplates the packing of three or four sizes at one time. The canvas-top table will probably give the most satisfactory service. In both of these illustrations attention is called to the "paper-hod" for holding the wrapping paper convenient for use. A spring needle is placed on the side of the "paper-hod" to hold the paper in place. Either form of packing table as well as the "paper-hod" can easily and cheaply be made by the grower.

Another very important piece of the packing house equipment and one which can also be made by the grower is the "nailing" or "box-press." Figures 18 and 19 show two types of press. In both presses the opening in the top of the table for the packed box should be large enough to accommodate the size of box which is being used, being somewhat longer for the "California" than for the "Standard" box. Likewise the iron "goose-neck" in the press, featured in figure 19, will have to be varied according to the box used. This goose-neck is the most important feature of this press, enabling the tops to be quickly and conveniently put in place. The latter press is recom-



Fig. 20.—A properly packed box of apples presents a similar face on top, bottom, and sides

mended as being simpler in operation and therefore cheaper to use. Tops, cleats, and nail stripper should be conveniently located to the nailing-press.

As the top is nailed on it is generally the duty of the nailer to properly mark either by machine or stencil the following information concerning the box: Variety, date packed, grade, number of apples in the box, net weight, and the name and address of the person or firm doing the packing. On the other end of the box an advertising lithograph is generally pasted. This is a very useful means of identification and a valuable advertisement if the grower keeps up the quality of his pack. This lithograph should not be in gaudy colors, but rather in tints and may or may not deal with fruit or fruit-growing scenes.

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ANNUAL REPORT OF THE MANAGER OF THE

CALIFORNIA WALNUT GROWERS ASSOCIATION

FOR THE 1916 SEASON

FEBRUARY 8, 1917

C. THORPE,
MANAGER

GENERAL STATISTICS

Year	Price of No. 1'm	California Production Pounds	Importations Pounds
1912	14c	22,024,000	26,662,441
1913	16c	22,378,000	28,632,867
1914	161 <u>/₂</u> e	17,778,000	31,543,621
1915	13 3/5 c	29,634,000	34,857,233
1916	15½c	27.410.000	36,876,297

Acreage Planted to Walnuts in California—1916

Bearing 42,670 Non-Bearing 16,000

Value of California Walnut Crop—1916 \$4,400,000

Number of Growers whose output is marketed through California Walnut Growers Association, 2204.

REPORT OF MANAGER TO MEMBERS, AT ANNUAL MEETING February 8, 1917

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17,655,189 pounds of unshelled walnuts were shipped by the California Walnut Growers Association during the 1916 season as against 18,193,074 pounds for the previous year, a decrease in weight of approximately 537,000 pounds or only about 3%. The proceeds of sales for the season just closed, including walnut meats, were, however, \$2,882,814.78, an increase over the previous season of \$376,295.14, the highest amount ever received by the California Walnut Growers Association for a single season's product.

The production of merchantable walnuts in California in 1915, the year of heaviest production on record, was 29,634,000 pounds; for 1916 the total State's production was 27,410,000 pounds, a decrease of 2,224,000 pounds, or approximately 8% under the banner year. In this same period the Association's volume decreased less than 3%, showing a net gain in the percentage of the crop handled by the Association of over 5%.

The actual sales cost for the 1916 season was the lowest on record, in round figures, $2\frac{1}{2}\%$, the appropriation for advertising DIAMOND BRAND Walnuts amounted to an additional $\frac{1}{2}\%$, and a fund of approximately $\frac{1}{2}\%$ was reserved for expenses of running the office until the 1917 crop matures, and for legal expenses authorized in connection with the rate case referred to below.

The California Walnut Growers Association is now completely out of debt, all current bills having been paid, and, as above stated, a sufficient reserve fund is available to carry the estimated expenses of the central association until about the time the coming crop matures without any necessity for borrowing money for office expenses, this being the first season that our financial condition has been in such satisfactory shape.

All departments of the California Walnut Growers Association have recently been more thoroughly perfected and systematized with a view to further economies which together with a slight revision in former sales methods will undoubtedly reduce the present low selling cost to such an extent that it is expected to market the 1917 crop at a further reduced selling cost.

The 1916 crop of walnuts was completely sold out more promptly than on any previous year in the history of the industry and at prices, with but two exceptions, the highest on record. The central association paid its local association members for every pound of merchantable walnuts packed by them as fast as such goods were made ready for shipment, making final returns on all first pool walnuts on or before November 23rd, and on second pool goods as soon as they were made ready for shipment.

Our trade generally had a quite satisfactory walnut season, made generally a reasonable profit, and were satisfied with both our time of delivery and quality. Owing to our perfected grading and inspection system we were able to turn out quality equal to our guarantee with the result that we did not have a single outright rejection during the entire season, an unprecedented record.

The importation of foreign walnuts during the past twelve months has been heavier than in any similar period, this notwithstanding the idea prevalent that the European war has limited or practically shut off importation. During the twelve months ending December 31, 1916, the importation of walnuts from foreign countries has amounted to 36,876,297 pounds, and the quality of imported walnuts this year is better than for many previous seasons. Notwithstanding this fact, the improved grading and inspection methods adopted for DIAMOND BRAND Walnuts have kept our line more than abreast with the foreign product, thus we are still leaders in both quality, price and preference on business, and the DIAMOND BRAND has even gained a reputation as against competitors' brands of California Walnuts of which we may all feel justly proud.

In order to get a more thorough distribution of our product in the middle western markets we have opened a branch office in Chicago which is being handled on a salary basis, under the management of Mr. H. B. Plummer, who was schooled by us through a season's experience in the Los Angeles office. As a result of this we have booked by far the largest volume of business for the 1917 crop that we have ever secured out of the Chicago market, and it is expected that our cost of securing this business will be considerably below a similar volume if handled through a Chicago broker. We were fortunate in securing the co-operation of the California Almond Growers Exchange in this undertaking, and the Chicago office is being operated and paid for jointly by these two organizations.

Our sales department has taken particular pains to secure an even distribution of the California walnut crop. In all of the states north of the Mason-Dixon line it has been our aim to secure an even per capita consumption, thus avoiding the possibility of placing an oversupply of DIAMOND BRAND Walnuts in some markets while in others the supply might be short. Our efforts in this line have met with unusual success so that we now believe our per capita distribution to be as even as possible and a great deal more thorough than most nationally distributed products. Within the past season or two, we have introduced California Walnuts into many new communities, where, until then, the product was practically unknown. Naturally, each new market developed stimulates additional consumption and a stronger national demand. Our sales

of the 1916 crop were made to 1660 wholesale grocers, and wholesale produce houses, and our sales organization now comprises 116 local brokers. In the southern states the per capita distribution is naturally considerably lighter than in the north, owing to the large percentage of the population being negroes, the latter using practically no walnuts whatever. We have, however, increased our southern business greatly, our product now being shipped in wholesale quantities direct to every state and territory in the Union, except Delaware and Nevada. The Nevada trade is supplied either through Los Angeles or San Francisco jobbers, there being no wholesalers in that state, and in Delaware the trade being supplied by either New York or Boston; thus it may be said that DIAMOND BRAND Walnuts are now sold in every state in the Union, and in practically every town of consequence. In 1916 we opened new California walnut territory in Cuba, Porta Rico, and Eastern Canada. Our business in all of these points will show a big increase this coming season.

The majority of both wholesalers and retainers having closely sold up on their California walnut purchases and secured a reasonable margin of profit, the wholesale trade have felt inclined to place their orders for the 1917 crop more freely than usual. The result is that we have already received contracts from practically all of our old trade and from a number of new customers so that now we have orders sufficient to move the entire 1917 crop with possibly the exception of Budded Walnuts. The production of these is increasing so rapidly that it is quite a problem to increase consumption as fast as production. The increase in this variety in 1916 over 1915 was 45%, and it is my prediction that either the quality and grading on this variety will have to be raised or the differential in price reduced in order to move the rapidly increasing production.

One of the big problems with which this Association will be confronted in the course of the next very few years will be the organization of the new walnut producing areas of California. Very heavy plantings are being undertaken in several sections, in the San Joaquin Valley, and other valleys of California, in fact, I believe that fully one-third of the plantings of the past season have been made north of the Tehachapi. Within the past year there have been at least 3,000 acres planted to walnuts in the San Fernando Valley. The establishment of a central bleaching and grading plant at Los Angeles may be worthy of consideration very shortly as the total of the walnuts produced in these various scattering districts is becoming quite an item and some means of grading and packing this production so as to deliver a first class product will have to receive consideration shortly.

The new walnut plantings for the last two seasons, and especially those of this present fall, have been a great deal heavier than most of us realize. At the present time it is almost impossible to secure walnut trees for planting from any nurseryman in the state, the supply of trees being fully contracted for, notwithstanding the fact that many nurserymen have grown an unusually large number of trees.

The present bearing acreage of walnuts in California is approximately 42,670 acres, non-bearing, 16,000 acres. The consequent increasing crop should

give the growers little anxiety providing our standards of quality are strictly maintained and improved upon. The markets of this country can be developed to absorb 100,000,000 pounds of walnuts annually at a price that will show the grower a reasonable profit, but an increase of consumption will depend to a large extent upon our ability to deliver a grade of walnuts entirely satisfactory to the consumer.

Within the past year there has been organized one new local association at Hemet, in Riverside County. These people immediately affiliated with the California Walnut Growers Association and established a temporary packing house to handle their output which was accomplished at a very reasonable expense and in a manner entirely satisfactory to their local members. Besides the organization of this new local which handles the output from about 400 acres, we have secured new members in old associations, adding over 2,000 additional acres of bearing walnuts to our holdings. We are now attempting to organize a new local at San Juan Capistrano and another at Walnut Creek, California, which is in the vicinity of San Francisco, and in which latter district about 200 tons of walnuts are produced annually. An attempt will also be made to organize local associations at some point in the San Fernando Valley, and at Pomona.

For the past several years we have been endeavoring, through conferences with railroad officials, to secure a reduction in the freight rate on walnuts, east bound. The present rate to all points east of El Paso and Ogden is \$1.40 per hundred pounds. This is the highest rate charged on any product of the soil of California. For instance, fresh vegetables take a \$1.00 rate, lemons, \$1.00 rate, and oranges, \$1.15 rate, all dried fruits, canned goods, and beans take a much lower rate. Our damage claims against the carriers for all breakage. pilferage, shortage, and of any other nature amounted to only \$548.16 as against total freight on our output amounting to \$260,000.00 or less than 1/5 of 1%. There is no apparent reason why walnuts should bear an excess burden. The results of our conferences have been negligible, and we have therefore employed the best legal talent obtainable to carry our plea for a reduction in rate before the Interstate Commerce Commission. The reduction, we hope for, will mean a saving to the producer and consumer of approximately \$60,000.00 per annum.

I cannot too strongly impress upon our members the advisability of the Association controlling all cull walnuts produced by its members. Fully 90% of the buyers of these goods sell the culls in their original state, that is, they do not crack them, although they often make statements to the contrary to deceive the grower. We are growing an ample quantity of good walnuts to supply the requirements of the trade. Every pound of cull walnuts sold the consumer displaces the sale of at least two or three pounds of first class goods, as the consumer forgets the cost of the inferior article and after finding that the culls purchased are of poor quality, simply blames the whole walnut industry and imagines that all walnuts of the current year's crop are of poor quality, and thus turns to the purchase of other nuts, such as almonds, Brazil

nuts, hickory nuts, etc., whereas, had first class walnuts been purchased in the first instance, repeat purchases would follow.

The present cracking plants which we have installed during the past year, have shown a great improvement over any of the crackers heretofore used. The result is that we have been able to build an enviable trade on shelled walnuts throughout the entire country. The quality of the shelled product we have sold this season has been such an improvement on any shelled walnuts heretofore packed, either domestic or foreign, that our brands have gained a popularity that will prove of inestimable future value to us. question but what we can secure prices on walnut meats approximately 20% higher next year than was obtained this year. This will mean larger returns to all growers on the culls they deliver us, and as the returns being made this year are approximately 20% higher than in 1915, this will mean a 40% increase in cull prices since our first undertaking in this line, two years ago. Every local association should pass suitable resolutions making it compulsory on all members to deliver their cull walnuts for shipment to the nearest cracking plant. The central Association assumes all freight charges on such shipments.

Our shelling department, while comparatively a new branch of the business, is rapidly being more thoroughly systematized. Thus a plan has been perfected for the payment to all growers of approximately 80% of the value of their culls on the day they are received at the cracking plant, thereby avoiding the delay in securing returns which has been necessary under the old plan of making payments only when each particular lot is cracked.

A small percentage of the California Walnut growers felt that prices established for the past season were perhaps too low. Naturally, any price that moves the California walnut crop without a carry over will develop an advancing market because if supplies are exhausted in producers' hands, wholesalers naturally stiffen their selling prices to a slight extent and both wholesalers and retailers buy a great deal more freely on a strong and advancing market. Some wholesalers thus find themselves short of supplies and if the producers are sold out they are forced to buy from competitors at an advance which naturally makes a strong market. Under such conditions wholesalers are inclined to speculate. They anticipate a shortage and all load up. times some of these speculators really overload and when they find themselves in this condition, they become anxious to sell and in some cases thereby weaken the market. This condition existed to a limited extent the past season. good many jobbers, thinking there would not be sufficient walnuts to supply the natural demand, overpurchased. Our competitors did not have as complete future sales as we did and most of them had heavy supplies of walnuts to offer at Association prices after we had sold out. A good many speculative jobbers seized the opportunity to buy these goods and in fact overbought, a condition they discovered around the first of the year and feverishly endeavored to unload at cost or slightly below if possible. Just at this time, the heaviest supplies of French walnuts were arriving in quantity causing the market to weaken further. Thus it is evident that had prices been named much higher, causing sales to be curtailed even to the extent of 10%, we would most certainly have been burdened with a carry over which would have been most difficult to dispose of late in the season in face of the unusually heavy importation of foreign walnuts of unusually good quality.

In line with the above statements, I quote from a letter, under date of February 3rd, from our New York agents: "Now, as to our spot situation, there is no doubt but that each and every importer of foreign walnuts is today losing more or less money. We believe that the only money made on foreign walnuts was on the early arrivals. There is practically nothing doing here at the present moment on any kind of walnuts, but fortunately for us, the quantity of California walnuts is practically nothing, with all jobbers happy and contented. It is only the importers that have a grievance, and as the writer has said to many of them, we would think they had enough; three years in succession, with a good heavy loss should cause them to lay off until conditions became normal."

Of course, the financial condition of the country was never more satisfactory than at the time the walnut crop was moved the past season. Labor was practically 100% employed and at wages approximately 40% above normal. The country was making money fast and spending it almost in the same manner. Such semi-luxuries as walnuts were purchased more freely than usual. It will be well to bear this abnormal situation in mind in considering prices when times again become normal.

I have one recommendation to make, and which I hope our members will strongly endorse. This is the employment by the central Association of a superintendent of packing house operation. Such a position should be held by a man experienced and expert, particularly in bleaching methods, and his authority for necessary remodelling of equipment, for the proper mixing of bleach material, etc., should be absolute. The greatest trouble we now experience in producing a quality satisfactory to our trade is in the appearance of our goods. A good many large lots of walnuts are ruined in appearance each year through improper bleaching methods, and a number of houses are not properly equipped to do a first class job. Consumers buy largely with their eyes and it is therefore of the utmost importance that we make our pack as attractive in appearance as possible. Several of the local plants are not equipped to dry the nuts soon enough after they are bleached. This causes delays in shipment which are costly to us, very unsatisfactory to the buyer, and also reduces the quality of the nuts. Either more modern drying bins should be installed or artificial drying apparatus provided. A decision on this matter should be reached at an early date so that the proper selection of a superintendent of packing house operation may be employed and his work started carly enough in the season to correct the conditions above referred to.

Respectfully submitted,

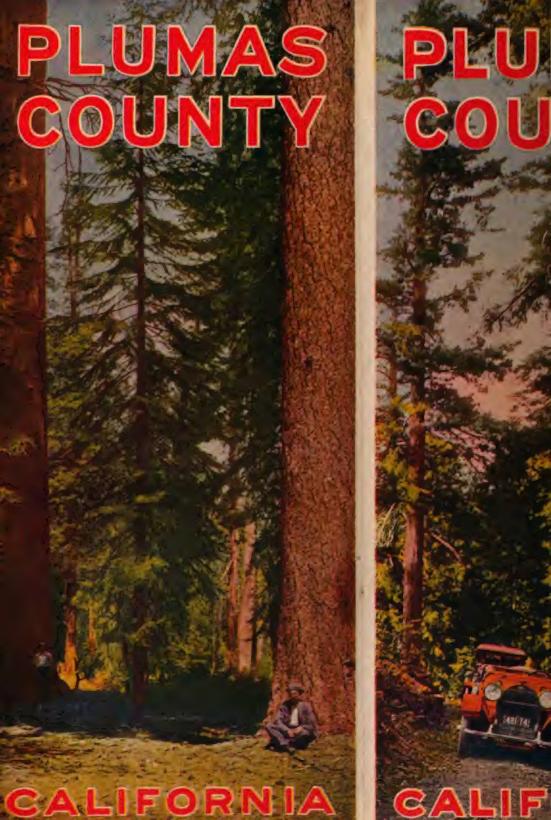
C. THORPE, Manager California Walnut Growers Association.

CALIFORNIA WALNUT GROWERS ASSOCIATION

Statements of Assets and Liabilities as of January 31, 1917

ASSETS		LIABILITIES	}
Cash on hand and in Bank. Bills Receivable Accounts Receivable, Good Machinery and	\$ 5,890.49 4,433.33 10,262.11	Notes endorsed for Local Association, a/c Bleach agreement Accounts Payable, Due	\$ 5,333.34 6.72
Fixtures— Furn. and Fixtures \$2135.85 Meat Plant Equipt 1917.91		Accounts Pay- able, Not Due— Consignments Received\$ 828.42 Culls 4964.17	·
Meat Plant Patents 216.00	4,269.76	Reserve for expenses to Sept.	5,792.59
Merchandise	7,317.53	1, 1917	21,040.57
	\$32,173.22		\$32 ,173.22







CRYSTAL LAKE, PLUMAS COUNTY, CALIFORNIA

MAS COUNTY

senting this booklet to the public, it is not the intention of the Board of rvisors, acting for the people of Plumas County, to make any misstate-regarding its resources. Every claim as to its opportunities can be tantiated with more than adequate proof.

t is a land teeming with possibilities for the poor man and capitalist, where a man of moderate means may increase his principal and where ten or twenty-acre tract may, in time, with some labor and a little ate a comfortable bank account.

NCEMENT

ars Plumas County has been she is now attracting much eking good investments. And

wealth stored in our forests, spruce, fir and cedar, is bed appreciated.

rn Pacific Railroad passes nty, opening up new avenues the timber belts, creating new enterprises, making greater demands for local products and increasing the value of business in all lines.

Because the Great Western Power Company has built one of the largest reservoirs in the county that is to be found anywhere in the United States, which will transmit electricity to San Francisco and furnish local consumers. This enterprise insures cheap power for milling, mining and manufacturing.

Because, cheap power and transportation now being assured, capital is seeking our gold and copper mines, the ancient channels of auriferous gravels and the numerous gold bearing quartz lodes in the county, as



SECOND CROP ALFALFA HAY.

well as the important copper deposits, affording an attractive and promising field for exploration and investment. Because our superior climate in Spring, Summer and Autumn, our balmy, invigorating and healthful atmosphere, our pure, cold water, our most beautiful scenery, our wild and rugged hunting grounds and our unrivaled trout fishing, make of Plumas a Summer resort destined to become one of the most attractive on the Pacific Coast. To make known, in a general way, the resources of this county, is the purpose of this pamphlet, and to its pages, the attention of the reader is invited. If he has not time to read the pamphlet now, let him put it in his pocket and read it at his leisure.

ITS GEOGRAPHY AND TOPOGRAPHY

PLUMAS COUNTY is in the northeastern part of California between latitude 39 deg. 35 min. and 40 deg. 26 min. North, and between 120 deg. 6 min. and 121 deg. 30 min. West longitude, with an area of 2567.81 square miles, or 1,634,400 acres of diversified mountain and valley lands, all timber, grazing, agricultural or mineral. The northeastern boundary is the main summit of the Sierra Nevada mountains, or western edge of the Great Interior Basin, the southwestern boundary being close to the foothills bordering on the great Sacramento Valley.

Plumas County covers nearly all of the watershed of the upper Feather River, in which are situated some of the most beautiful and fertile valleys of the State, chief among which are Indian, American, Big Meadows, Genesee, Mohawk and Sierra.

The greatest dimensions of the county are, from east

to west, 71 miles; north to sowest to southeast corner, 871/

The approximate acreage cipal valleys of Plumas are a

Indian Valley American Valley Genesee Valley Spanish Ranch & Meadow V Spring Garden Valley Snake Lake Valley...... Butt Valley Humbug Valley Big Meadows Mohawk Valley Sierra Valley (in Plumas)... Warner Valley Buck's Ranch and Haskell Va Hot Spring Valley..... Red Clover Valley..... Lone Rock Valleys..... Last Chance Creek Valleys... Dixie Valley Grizzly Valley

RAIN AND SN

The situation and topograthat she is blessed with a heaverage amount of rain (sm being about 41 inches yearly mountains, the snow does not Spring or early in Summer, the which insures an ample am



8 miles; from north-

ultitude of the prinows:

Altitude Acres 17,9603500 to 3600 6,640 3350 to 3550 3,080 3600 to 3800 2.240 3800 to 3900 3203850 to 4000 6004000 to 4100 2.0804100 to 4200

1.880 4200 to 4400 25,480 4250 to 4600 5,3204350 to 4600 67,5204850 to 5000 1,200 5000 to 5200

3,480 5000 to 5300 400 5200 to 6000 9,040 5350 to 5500 1.120 5400 to 6000

6,560 1,720 5600 to 6000 8,840 5700 to 5900

5500 to 6000

FALL

of Plumas are such terfall annually, the reduced to water) many of the high pear till late in the ring a water supply for irrigation and



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Summer months the atmosphere being dry, the warmest days cause no depression, as in States possessing a humid atmosphere, and the nights are pleasantly cool and sleep is refreshing.

SOIL AND PRODUCTS

In Plumas, there is virtually no limit to the fertility of the soil, especially that forming the valley lands. which was made from the alluvial deposits carried down from the overhanging mountains by the rains and melting snows of centuries. The soil in Sierra Valley, generally speaking, is a sandy loam, and particularly adapted to the production of barley, wheat, rye, alfalfa and the natural grasses, especially where irrigation is available. The rainfall there, however, is not so heavy as in the central, southern and northern parts of the county, but this can be compensated for by the construction of storage reservoirs, by means of which thousands of acres of the lands situated on the gentle slopes may be made to yield alfalfa, grasses and grains in profusion.

At a comparatively small expense, a great reservoir could be made by placing a dam across Adams Creek, at the upper end of Adams Neck, and in this could be stored for future use, the floodwaters from an extensive watershed.

It remains for the agriculturalists and dairymen of that part of the county to organize for the construction of this reservoir themselves, or to lay the tempting proposition before capitalists, who, on their investments, would realize a handsome profit and enable those portions of Sierra Valley irrigable from this reservoir to be placed in a high state of cultivation, thus



A PLUMAS COUNTY WHEAT FIELD

adding to the wealth of that already rich and prosperous section. The larger valleys in which the cereals, fruits and vegetables are most successfully grown, are Indian, American and Genesee, while those of higher altitude are devoted mainly to the production of native and cultivated grasses for hay or pasture, and, therefore, are devoted chiefly to dairying and stock raising. All of these valleys are well watered. Pure mountain streams abound, and these are very desirable for dairying and general farming. What has been said of these two classes of valleys is true of the numerous smaller ones of approximate altitude.

DECIDUOUS FRUITS

Many parts of Plumas County are well adapted to the production of deciduous fruits. Apples and pears thrive and the yield is very large. Plumas prunes, nectarines, peaches, pears and cherries do well in many localities, and where favorable conditions exist, the trees are very prolific. The berry and smaller fruit family are peculiarly well adapted to this climate.

Currants, gooseberries, blackberries, raspberries and strawberries grow in great profusion and perfection. The fruits grown in this section have a crispness, juiciness and flavor rarely equalled and never excelled by those in fruits produced in other parts of the State. Plumas appears to be the natural home of the apple, and the growing of it for the outside market is destined to become one of the great industries of the county. While the quality of the apple produced in this county cannot be surpassed by those produced in any other part of the world, the quantity which can be raised on

an acre of land adapted to f incredible. In many parts of of apples have been grown eighty trees to the acre, then the enormous yield of 200,000

There are hundreds of acr ders of Plumas which are ex the growing of apples, pearrines and cherries, as well as fruits and berries. These lan numerous bars and benches al Forks of the Feather River at clearing in most instances w pare these lands for cultivati the Western Pacific Railwa the establishment of many so has resulted from the consroute through the Sierras.

VEGETA

Indian, American, Genese of equal or lower altitude, Ithe quality of the vegetables superior. Potatoes, cabbage, celery, turnips, radishes, pea fection. There has been propounds of potatoes, 40,000 pounds of beets. S Western Pacific Railway, and ment of our great timber ar local demand for the producreased.



lture, seems almost ounty 2,500 pounds ne tree. Allowing rate we would have ds per acre.

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those other valleys ong been noted for ced. They have no carrots, cauliflower, are grown to perto the acre 30,000 of cabbage, and he building of the consequent developneral resources, the as been greatly in-



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establishing more co-operative creameries, where butter of an even and superior grade may be manufactured at the least cost and then sold to the best advantage.

TIMBER RESOURCES The Great Area of Pine Forests in Plumas

One of the greatest resources of Plumas County which is now being actively developed, is her extensive forests of pine lands now attracting the attention of capitalists desirous of making safe and profitable investments. Excepting the valleys proper, nearly the entire surface of the county is covered with an excellent growth of coniferous forests, much of them dense. and the lumber produced therefrom first-class. principal growth is "California white pine," sugar pine, spruce, fir, cedar and tamarack. Sugar pine grows in numerous favored places, and along with it is to be found the white pine, the trees of both being of large size, the grain and quality of the wood fine. and the lumber commanding a high price in the markets of the world. An invasion of this forest has scarcely begun, but since the building of the Western Pacific Railway through the county, numerous sawmilling enterprises have sprung up along the line of the road which but serves to demonstrate the great wealth stored up in these pine forests, with the result that they are now receiving merited attention. vidual entrymen made purchases of these timber lands years ago, and later sold their holdings at a good profit to capitalists having in view the establishment of large milling plants and factories incident thereto. large tracts were titled and have been held up to the present time, untouched by the axe and saw. Many



IN THE WOODS OF PLUMAS COUNTY,

of the holdings in the county have become so large that the owners thereof have entered upon the manufacture of lumber on a large scale and many mills and box factories have been established at various points in the county within the last few years.

It may, therefore, be taken for granted that our forests will be still further utilized in the immediate future, thus adding largely to the volume of business and the prosperity of the county, not only indirectly, but as well by stimulating activity in mining, agriculture, dairying, stock raising, and all other lines of industry. The acquisition of timber lands by individual entrymen has been prevented by the establishment of the National Forest Reserves which now cover all the vacant timber lands within the county. The Government permits the ripe, merchantable timber within the boundaries of the reserves to be sold to individuals, for immediate manufacture, under certain rules and restrictions and many companies and individuals are now purchasing and manufacturing this Government timber into lumber and its kindred products, which are being shipped to all parts of the world. The climatic conditions in Plumas are such that the growth of the timber is very rapid. As the larger trees are removed, a thick young forest springs up. This is evidenced by the young trees now growing where their predecessors were cut down say forty-five years ago and since.

PLUMAS MINERAL RESOURCES Gold Mining is Yet in Its Infancy.

Since the early "fifties" gold mining has been a leading factor in the business life of Plumas County.

Gravel mining first received at on the North and Middle Forl their tributaries yielding richly methods were employed by the bars received their gold from contained in the channels of a cut by the present streams, an from the thousands of quartz ve and disintegrated during the present canyons were formed erosion, some of the finer par were made finer and were ca streams to the delta at the monear Oroville, in Butte County, immense beds of gravels which mined by the dredger process. ever, was left behind, and on tl been drawing since the white country. As an illustration of from these placers, it needs o firm, that of Thompson & Kell business at Spanish Ranch, p 1900, approximately \$2,000,000 that the district tributary to the by the way, has since been aba of the older mining camps thro produced fully \$25,000,000. N been many other of the older over the county. While most caused by "breaks" from ane mined, many deeper gold-bear of ancient channels, are availab mining.



tion, the shallow bars f Feather River and ven though primitive oneer miners. These e auriferous gravels ent drainage systems y the deposit of gold and stringers eroded g ages in which the By the process of es of precious metal ed by the torrential of the great canyon, d there settled in the ve been so profitably ie coarser gold, howsupply, the miner has an first invaded the large yield of gold to be said that one , in conducting their hased, from 1863 to gold. It is estimated trading post (which, ned like many other out the county), has less productive have ing camps scattered the shallow deposits channels, have been gravel beds or parts or sluice or hydraulic



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appears on the east side near the Denton ranch, and then extends northwesterly about 15 miles to Grizzly Creek, breaks from which channel furnished the rich deposits found in Jackson Creek, Coggswell's Ravine. Big Long Valley Creek, Little Long Valley Creek, McDermott Ravine and Grizzly Creek. In the gravel deposits from these breaks, some very large nuggets have been found, \$666, \$325, \$125 and less, the break into Jackson Creek alone having yielded about \$100,000. which facts illustrate what may be expected by companies that develop this ancient channel, which, because of its length, the large gravel deposits and their evident richness, offer a very promising field for mining capital.

Quartz Gold Mining

One of the greatest and most valuable resources of Plumas County is her quartz gold mines. only those of higher grade have received much attention, and scarcely any of these have been mined "below the grass roots." In them and their milling plants. poor equipments have been in use, and methods of mining and milling not up-to-date have, with a very few exceptions, been employed, with the result that the cost of mining and milling and the percentage of gold lost, have been too great. But now that cheaper and better transportation, together with the cheap electric power which our mountain streams can furnish in practically unlimited quantities, are among the certainties. it is equally certain that the higher grade ore bodies will be mined at greater depth and profit, and that the low grade propositions will be developed and worked on so large a scale, and so economically, as to pay good



HOLSTEIN DAIRY HERD, AMERICAN VALLEY.

dividends. Notwithstanding the adverse conditions under which quartz mining in this county has been prosecuted, many have yielded good returns on the investment.

Eastern Quartz Belt.

There are two distinct and prominent quartz belts passing through the county, one a continuation of that of which the Sierra Buttes and the Keystone, in Sierra County, are parts, the belt extending northwesterly into and through Plumas. The Four Hills Mine, just south of the county boundary, also is a part of this great mineral belt. A short distance north of the Four Hills, and in Plumas County, is the Little Jamison Mine, an actively operating and paying quartz mine of large extent and great promise, having up-to-date hoisting machinery and operated in harmony with modern methods. The Little Jamison is just across the canyon and about a mile south of the Plumas Eureka, and evidently is part of the same lode. The Plumas Eureka was mined actively for over forty years, during which time its gross yield was approximately \$30,000,000. During this period of time, most of the high grade ore, above the present milling plant, was extracted, so that with the appliances at hand, the remaining ore bodies could not be very profitably worked.

Neither could the high grade ores below the level alluded to be mined and delivered to the present mill without a new plant. But we are informed that plans are maturing to open up this mine at depth and to equip it with modern machinery. This done, the millions of tons of low grade ore now available and the rich deposits surely below the present workings, as evidenced

by the good ores found at a m. Little Jamison Mine near by Plumas Eureka what it was fe great producers of the State.

This same mineral belt co westerly to the Argentine Dis Garden. This mineral belt, the heavy gold found in the se heads the main lodes appear to rel, Massack and Taylor Creyielded treasure. That stret-Argentine District across to leys, hitherto but little investi for the development of gre Plumas Eureka and the Litt tion of this belt is to be found and Indian Valleys, quite disti northern base of Mt. Hough as Range, extending northwester as the Old Gold Stripe Mine. of greenstone. The Green Moits mineral deposits, and wit and modern methods of presen ous low grade mines of magni and become heavy producers. tion in that section for the pa mines along the belt is as fo Crescent Mine Green Mountain Mine Cherokee Mine Indian Valley Mine...... Gold Stripe Mine

Others Total



ch greater depth in the will again make the forty years, one of the

inues its course northict, northeast of Spring vidently has furnished ral creeks across whose run—Greenhorn, Squirs, all of which have of territory from the dian and Genesee Valted, offers a good field mines similar to the Jamison. A continuathe vicinity of Genesee tively appearing at the in the Green Mountain past Greenville as far nd lying east of a belt tain Range is noted for the improved facilities day mining, its numerle should be developed The estimated producthirty years from the WS:

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AMERICAN VALLEY.

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ther east and near the greenstone which separates if from the eastern belt, are several very promising bodies of ore, including the deposits in the Butterfly District that east of the Shoo Fly Bridge, the Plumas National Group, and the Dunn, the Bear and the Horseshoe on the North Fork, all of which carry a heavy percentage of sulphurets. The districts named are a good field for exploration and development.

THE PLUMAS COPPER BELT

A Section Now Attracting the Attention of Capital

A part of the "Eastern Quartz Belt" previously dicussed, is that having its origin in and extending north westerly from the mountain range north of Portola. distance of over thirty miles to the Mountain Meadov country, beyond which it disappears under the grealava fields of Lassen Buttes, then reappears in Shasta County. This copper belt extends a distance of at least thirty miles in a northwesterly direction through Plumas, touching the southwest corner of Lassen County, then passing into Shasta, where it continues along the main belt upon which so many important developments have been made and which is one of the largest producers of the world's copper supply. In Plumas the average width of the belt is ten miles. Immediately west of Mt. Ingalls in Township 25 N. R. 12 E., there are a number of prospects of considerable merit and considerable development is now being done on them by Salt Lake capitalists. From the head of Ward Creek almost to its junction with Indian Creek, locations have been made and more or less labor performed thereon. The general quality of the ores is of a silicious



SAW MILLING PLANT OF QUINCY LUMBER CO.

gangue carrying gold, silver and copper of a grade sufficiently high to insure their working at a profit. The gold in this part of the belt shows as high as any in the county. The copper in these complex ores is Glance Cu. and oxides mainly from the leachings near the surface. The gold, in many instances, shows metallic to the naked eye, giving some high assays.

In Genesee Valley there are some fine ores, the general character of which closely resembles that of those found on Ward Creek, the gangue and minerals being nearly identical. The belt, in this valley, is wide, showing copper croppings very often more than four miles. The country rocks are igneous, principally granitic, with a little feldspar and much silica. Some of the ore in this district assays more than 50 per cent copper. On the north side of Genesee Valley there are some fine ores carrying from 30 to 50 per cent copper, but merely a trace of gold. Not much work has been done. All of the prospects, however, show ore from the surface down. The ores in this group will assay, on an average, 20 per cent copper.

Crossing the apex of the mountain between Genesee and the north arm of Indian Valley, the properties on Peter's Creek are reached. The Bonanza shows a well defined vein of ore forty feet wide. Here the sulphides are heavier, but the ores are more complex, carrying gold and silver in addition to copper. At this point, the belt is more than eight miles wide. Less than two miles south there is a strong belt of lime, which would afford sufficient flux for the ores of this district for all time to come. South of the last mentioned on Mt. Jura, are prospects which assay as high as 60 per cent copper. On Motgomery Creek, between Indian and

Genesee Valleys, in early desome of the prospects of sufment to San Francisco for recwas such transportation at the worked at "Coppertown." the district, arsenical pyrite dominate. The Engle group Light's Canyon, and they arsiderable work has been done on the dump. This property at the present time and larg being hauled by auto trucks on the Western Pacific Rai smelters in Utah.

Across the canyon from t valuable prospects, all show trating proposition, is almost these again to the west are t Here some work has been do and quantity of the ores ar veins. In Cook's Canyon, f face indications are such as the mountain between Indi Meadows, opposite the India much good ore lying on the st on three sides of this mount posing many tons of sufficien Some of the highest grade of per belt, have come from pr district. Another group of lo the head of Wolf Creek. croppings the entire length, a 200 feet in width. This gossa



ient value to bear shiption, though very costly time, while others were this particular part of and surface oxides precopper properties is in of great promise. Conere and much ore is now being actively worked uantities of the ore are om the mine to Keddie

ly for shipment to the

last named, are several

good ore, as a concenexhaustible. Adjoining "Moonlight" locations. that shows the quality he permanency of the ier southwest, the surjustify exploration. On Valley and Mountain lission School, there is ice, in numerous places, with "blow-outs" exlue to pay for working. ever found in this copects in this particular ions may be found near s group shows gossan in places, in excess of ssays about \$3 per ton









RESERVOIR, BIG MEADOWS.

he development of electricity in this State is going on a rapid pace. We read of five, ten and twenty thouand horsepower plants being established, but that now bing built in Plumas will eclipse all others in Califoria. The Great Western Power Company bought about 5,000 agres of land in Big Meadows for reservoir purbses. By means of a great dam across the North Fork I Feather River at the lower end of Big Meadows and pipe lines to the bottom of the North Fork Canyon, is proposed to use this water under about 1200 feet ressure in a mammoth electric plant, take the water p a second time, earry it by means of a canal further own the canyon, drop it again and use it at a second lant, thus developing at the two plants 300,000 horse ower. The locations by the company cover 120,000 aches of the waters which flow through Big Meadows.

he preliminary work has been done and the great dam as been placed in position and the water impounded, lut for the present this reservoir is only being used as n auxiliary to furnish the plant at Big Bend with suffilent water to operate the electric units now in place. ut as these are taken up through the requirements for dditional current the second plant will be installed in he canyon below Butt Valley. It is proposed to conluct the electricity to San Francisco and other points h the State, and to supply local demands. The high ltitude and rapid descent of our mountain streams, ogether with our heavy annual precipitation, offer in 'lumas exceptional opportunities for the development Particularly is this true of the North f electricity. fork and its tributaries and in a lesser degree of the Jiddle Fork. At numerous points on the former stream proper, on Indian Creek, on the East Branch, on Buck's



U. S. EXPERIMENTAL STATION.

Creek and on Yellow Creek, plants could be installed, to say nothing of those possible below the Round Valley reservoir, the lakes at the top of Spanish Peak, and the many plants that could be located on the Middle Fork of the Feather River. Ample electric power, therefore, is available for all local needs—to operate mines, sawmills, box factories, paper and other mills, to run electric railways through the county, and to supply much of the electric power used in and north of San It is almost impossible to find words to express the magnitude of the power contained in the water supply of Plumas County. Beside the North and Middle Forks of the Feather River, with their numerous branches, there are hundreds of creeks and streams whose waters ripple the year round, so great is the amount of water shed from the mountains when the snows melt in the early Spring. Along the tops of the ranges there are many lakes whose waters have with few exceptions, never been claimed, and are only waiting to have the attention of the empire-builders directed their way to develop power and irrigation for thousands of acres and thousands and thousands of people.

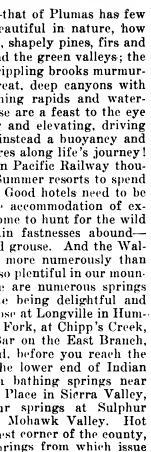
SUMMER RESORTS

In This Respect Plumas Growing More Popular

Plumas is growing more and more popular as a Summer resort. During the heated Summer months particularly, people from the valleys and cities of lower altitude seek our lovely mountain retreats to regain health or seek pleasure. The pure atmosphere laden with the ozone of the pine, fir and cedar, tones up, refreshes and improves both body and mind. And the pure, cool water from our mountain springs, how refreshing, how

delightful to drink! Scenery To the lover of the tempting to the eye are the ta cedars; the grand mountains glassy mountain lakes and the ing in the shady glens; the their rushing rivers; the fo falls; the clear, blue skies—th and the soul, at once inspiri away dull cares and bringing gaiety of spirits, golden treas With the advent of the West sands now seek her numerous a few days, weeks or months opened and maintained for t cursionists. The nimrod will game with which our moun the bear, the deer, the quail a tons, with hook and line wi ever, beguile the sportive trou tain streams and lakes. Th in Plumas, the waters of so healthful beverages, notably t bug Valley, those on the North at Virgilia, Twain and Soda and on the Indian Valley Re summit, at Indian Falls and There are fine wa Greenville, also on the Marb and the renowned cold sulp Spring Ranch at the head Spring Valley, near the north contains scores of rumbling







B COUNTY, CALIFORNIA.

the waters of the North Fork are deep and the supply of food for fish is abundant. That part of the county is deservedly celebrated as a fishing resort, and to it come people from all parts of the State. The other most notable fishing grounds are the North Fork below Big Meadows, the Middle Fork, Warner Valley, at the base of Mt. Lassen, Genesee, American, Clover, Grizzly, Mohawk, Spring Garden, Bucks Valleys, Willow Lake and the numerous mountain lakes in the vicinity of Johnsville and south of Old Mohawk. These places are the favorite haunts of such as enjoy fishing for the most sportive and edible of the "finny tribe," the mountain trout. The policy of the State and the county is so to protect the fish as to keep up the supply. The "close season" is from November 1st to May 1st. From time to time, importations are made from the State hatcheries to preserve the supply and the varieties.

TOWNS AND COMMUNITIES

Portola, the leading town in the First Supervisorial District, and also one of the most important in Plumas County, sprang into existence in 1909 when the Western Pacific Railway made its advent into this section of the State. Portola has a population estimated at six hundred inhabitants. Portola was named after Don Gasper de Portola, the discoverer of San Francisco Bay. It is situated in the northern part of Humbug Valley, on the headwaters of the Middle Fork of the Feather River, in the high Sierras, at an altitude of 4832 feet. and commands the entrance to the famous Feather River Canyon via the east portal. This town is a division point for the Western Pacific, which corporation gives employment at this point to 200 men.



WESTERN PACIFIC RY. STATION AT PORTOLA.

The Boca & Loyalton Railroad has its west terminal here and rail connections with the Southern Pacific are made at Boca. The Sierra Valleys Railroad, a branch of the Nevada, California and Oregon Railroad, is a third steam line to enter Portola. The fown during its short career, has made wonderful strides in development. Excellent schools have been placed at the disposal of the young generation; two religious denominations have constructed places of worship, a splendid commercial hall graces Commercial Street, the main thoroughfare: two strictly modern hotels have been built, beside a number of first-class lodging houses. An electric lighting system is now being installed, the poles are up and the wires being strung; also an efficient volunteer fire department has been organized. Owing to a restriction clause placed in the deeds to the property by the townsite owners, it is illegal to sell liquor in Portola, consequently this town is dry. The present water supply of the town, which is as fine as can be found in any mountain town, is piped from a natural spring on Beckwith Peak, three miles distant. Two live wire booster organizations are boasted of in the Portola Chamber of Commerce and the Portola Woman's Civic Improvement Club, which societies may be depended upon to support any proposition displaying a tendency to promote the best interests of the town and of Plumas County. Portola is destined to become a most important factor in the development of Plumas County, owing to its railroad facilities. In the Western Pacific it has direct communication with all castern and western transcontinental points of importance; the Roca & Loyalton Railroad connects with the Southern Pacific and the Nevada, California and Oregon line is a direct

feeder to Portola and vicinity also Reno. Nevada.

Beckwith, with a populat dred, is near the foot of Sier: Loyalton Railroad and also the Oregon Railroad. The Weste cated one mile southeast of the named after Jim Beckwith, the land trapper who discovered the analtitude of 4874 feet. Good there is one church, a preter hotels, several well stocked a facturing 2000 pounds of butte trading point for farmers living miles. The products of the fare shipped into the open materials.

Vinton, a small town on California, Oregon Railroad, ern section of Sierra Valley, from Beckwith and four mil The leading industry in this dairying. Large shipments natural hay, oats, barley and this trade center.

SIERRA VA

One of the most productive Plumas is located in the souther and is named Sierra. This valuand west and twenty-five miles at altitude of 4800 feet. Those tive hay are harvested every strye, wheat and barley are a



rom eastern Oregon and

on of about three huna Valley, on the Boca &
e Nevada-California and
en Pacific Stations is lone town. Beckwith was
e famous Indian fighter
e Beckwith Pass, and has
schools are located here,
tious Masonic Hall, two
ores, a creamery manur daily. Beckwith is the
g within a radius of ten
trms, dairies and ranges
rket from this point.

is situated in the easta distance of ten miles is from Beckwith Pass. vicinity is farming and if milk, cream, butter, alfalfa are made from

LLEY

e valleys to be found in astern part of the county ey is fourteen miles east as north and south, with sands of tons of fine naeason. Immense crops of so cut. Alfalfa thrives



TY HOSPITAL.

rheumatism that have been made at this resort, is located in Sierra Valley, two miles from Beckwith.

INDIAN TOWNSHIP

You enter this township shortly after leaving the Western Pacific at Keddie. However critical your mood it melts into childlike pleasure as you follow a winding road whose Alpine beauty is too wonderful for words; where every turn shows new marvels of nature's art; miles of river canyon that are simply one bed of glistening foam. On every side moss covered rocks, where lacy ferns peep from every crevice; rippling waterfalls that gurgle down from high and hidden springs. From every eddy and ripple the speckled beauties jump to catch the venturesome fly. The pass opens on a sun-kissed little valley whose vine-covered tavern and rose embowered homes throw out perfect rays of gladness and Indian Falls makes never-to-beforgotten music. The town of Indian Falls plateau 200 feet above Indian Creek, which at this point has a fall of 360 feet in a mile and the rapids for ten miles are the most picturesque in the United States. A \$3000 school building is in course of construction and a splendid tourist hotel affords accommodation for sixty guests. This region is well timbered and here too are more than sixty mineral springs in an area of less than 40 acres. The town is surrounded by forest-clad hills 2500 to 3000 feet high that protect it from sudden climatic changes and it is noted for its fine fruits and beautiful roses. Farther on, past cliffs, past bowers of dogwood and sweet birch, through avenues where the long-plumed maples arch the road until the curtain of the hills lifts and beautiful Indian Valley lays in a cup-



A PLUMAS COUNTY APPLE ORCHARD.

like hollow 38 miles in circumference with an average width of not more than two miles, encircled by snowcapped hills, whose sides are covered with a dense forest of cedar, fir, oak, pine and spruce. In the meadows graze numberless herds of cattle knee deep in clover, and commodious farm hourses dot the landscape and give a touch of human interest. Nestling among the green, within easy distance lakes abound, Crystal, Homer, Round Valley and Taylor, all richly stocked with bass or trout. To these shores in the early hours when the birds are giving their first salutations to the dawn the deer and bear come down to drink. What Killarney is to Ireland, Indian Valley will one day be to California. There are five towns in Indian Township, Greenville and Crescent Mills, both situated in rich farming and mining districts. Greenville has its own electric, water and partial sewer systems. Indian Valley Bank is situated here, whose deposits last year aggregated \$65,000. There are two churches, two hotels, five stores, a ten thousand dollar grammar school building and many fine homes. The Indian Government School is four miles distant and has an enrollment of 100 pupils. The Round Valley reservoir is located just outside the town. This body of water has a drop of 800 feet and is capable of generating 1000 horse power. The water after leaving the power plant can be used for irrigation purposes. Greenville is also the nearest town to the famous Prattville fishing grounds and Canyon Dam. It is 16 miles from the railroad and auto stages leave here for all points, including Mt. Lassen.

Taylorville is picturesquely located at the base of the mountains and is the supply point for the great copper interests that are been Canyon and Genesee. The twhich enjoy a good tourist tstores, a blacksmith shop and residences. Here too is open Creamery, which buys all the manufactures a high-class graneady sale. Genesee is the township and is a value district.

Mini

Millions of dollars have be and while the upper levels in well worked there are rare opment of capital in the further eral resources, not only in golmining but in the manufact lime. The Jura Channel runs is supposed to be the princigold. There is considerable and Indian Valleys suitable mineral belt contains several dreds of promising prospects.

Farmi

All kinds of grains, vegeta The farms are large but are into smaller tracts. What the practical farmers to develop

Dairy

This will one day be the p valleys in this district. Then



ioneer mining towns of ,000 in gold have been cer mines in the immescovery of placer gold lumas Eureka quartz arly thirty millions of h were paid out in divace has produced nearly d nearly four hundred

e, made famous a few the very grass roots of valued at two hundred the southeast of Johnsare turning out thoubeing only worked on in systematic prospectundoubtedly open up this section. With the Railway, access to the e is in the veary heart, nd this section has beesort for tourists and stocked with Rainbow ithin casy walking dison and Eureka Creeks, fer excellent sport to Cour hotels furnish acce of beautifully timr afford ideal Summer outdoor life.

Plumas and has about ful little town nestled



BIL SCHOOL BUILDING.

SCHOOLS AND CHURCHES

The public school system of Plumas is on a par with that maintained in other counties of the State. At the present time, there are thirty-one districts. The schools are under the general management of a County Board of Education and a County School Superintendent, the teachers, however, being employed by local Boards of Trustees. In the course of study eight grades are provided for, and when the students have completed the course of study and passed a satisfactory final examination, diplomas of graduation are issued to them. That our county schools do good work is evidenced by the fact that so many graduates from them have been able to make excellent records in higher institutions of learning, or enter upon successful business careers here and elsewhere.

A splendid county high school, with four teachers, is located at Quincy. All through the county there are schools, wherever the population warrants it.

Nearly every town or village has its place of worship, and the usual denominations are represented, prominent among which are the Methodists and the Catholies.

MINERAL AND SENECA TOWNSHIPS

This is undoubtedly one of the most interesting and beautiful parts of this wonderful country and the traveler first enters it when he crosses the line between Butte and Plumas Counties, while traveling on the Western Pacific and following the beautiful bold scenery of the North Fork of Feather River, teeming with trout and carrying untold values of gold placer deposits deep down in the gravels under the rushing



A PLUMAS COUNTY FARM RESIDENCE.

INDIAN MIS

waters. Every few miles there are stations where can be found stopping places for those bent on fishing or hunting and trading points for the miners engaged in the vicinity.

Belden is an enterprising point for here the traveler leaves the railroad for points in Humbug Valley, the site of the reservoir of the Oro Light and Power Co.

Farming is also carried on to some extent.

At Belden there are two hotels and a general merchandise store. Mining is carried on in the surrounding country and there are several mineral springs which deserve attention.

Farther up the canyon we come to Virgilia, in the neighborhood of which is a country as yet undeveloped, although there are several ranches already laid out and planted to fruit, alfalfa and clover. The altitude here ranges from 3000 to 4000 feet and the apples produced are unsurpassed by any in the world. Peaches, pears, plums and cherries, as well as small fruits, bear large crops regularly and in flavor have no equal.

Mining has always been carried on here and until recently was confined to the working of the placer deposits along the river and creek beds, which has led up to and uncovered the lode on which are located the Hallsted, J. M. Little and Cameron quartz mines. Here also are the large lime deposits of the Pyrimidal Mines, comprising hundreds of acres easy of access and extending from Rush Creek to the top of Cherry Peak, having an altitude of more than 5000 feet. This lime is of the finest quality and offers an unusual field for development on account of its nearness to the Western Pacific Railroad, and the close proximity of the unlimited power of the Great Western Power Company's

plant, as well as the large b Rush Creek.

At Twain, the next statio the eastern boundary of this ern, a hotel where you get ethe market affords, where t fine and the hunting good, springs, both hot and cold. It into the to be one of the leading The store at this point is t miners along the river, as with north. There are large to this point with good sites

In the southeastern port beautiful spots where are situ ish Ranch and Meadow Valle of fine timber, streams and numerous Summer resorts a where farming and mining is

Some fine vegetables are and most of the hardy fruits

In the northern portion is "Big Meadows," wherein is the Great Western Power Clad mountains of the finest of meadows containing farm uriantly and large bands of to the markets of the State.

Here is the source of the the Feather River, which is eddreds of thousands of horse p developed but destined to be of power in the world.



ON SCHOOL.

lies of water flowing in

up the canyon and near strict, is the Twain Tavrything of the best that fishing in the river is there there are mineral ideal situation and descents along the railroad. Trading place for the ll as the large mines to dies of timber tributary milling plants.

n of these districts are ted Buck's Ranch, Span-

Here are large forests akes stocked with fish, d thriving communities arried on.

aised in Meadow Valley

o well.

a large valley known as be great reservoir site of surrounded by forestmber, immense stretches where hay grows luxsittle are raised and sold

onderful North Fork of pable of furnishing hunwer as yet only partially fe of the greatest sources



PLUMAS COUNTY, CALIFORNIA

WORD ABOUT FARMING

lower valleys they produce splendid crops of the ver finest fruit. Plantas has some of the best apple of chards in the State, considering their size, and with fair start will supply a large demand. Berries throseven in the higher altitudes, and owing to the creaters of the climate, the quality is unsurpassed. At the lowest altitudes on the benches and bars of the East Branch and North Fork, there are now many such orchards in full bearing. Potatoes, cabbage, beets, out the protest celery and all of the hardier vegetables growth the protest of the start of the protest of

perfection. All kinds of hay and grain may be raise in any of the valleys, timothy hay seeming to be th favorite growth of the farmers, as they claim that th hay is of such quality that little or no oats are necessary for the stock when fed on Plumas timothy hay.

The stock here raised is of a very fine breed. Ever year the buyers for all of the large cattle dealers rid through the county paying fine prices for the cattle raised upon the ranches.



List No. 1

WOOD UTILIZATION SERVICE CALIFORNIA STATE BOARD OF FORESTRY

A hardwood dealer, whose name will be furnished

Locust Offered.

request, has a large number of pieces of locust 1 3/8 in square and from 12 to 16 inches long, which will not sathe requirements for treenails and which he will sell as

At the present time there is on hand the following mate:

1 3/8" square Locust treenails: 3309 pcs. 12" long 146443 " 14" " 81322 " 16" "

Small pieces of the size given above might profitably be for insulator pins and brackets, electrical parts, hand steering wheels, ladder rungs, spokes and articles of a nature. Any concern that can use this material will be in touch with its owner by writing to the State Forester.

Sacramento. California.

mished upon 3/8 inches yi satisiy , t rig11 at cost. ythi fis material: ide sorti tra l as dies of n ted I durable. akesbly be used rarric handles, aised handles as in lar of a similar of a similar segre growth be put in ber who who segre who segre who segre who segre who segre as a similar segre who segre who segre as a segre who segre who segre as a segre who segre onde epable wer a ife of

AGRICULTURAL SCIENCES

Vol. 3, No. 4, pp. 55-61-

November 27, 1917

A NEW DENDROMETER

DONALD BRUCE

UNIVERSITY OF CALIFORNIA PRESS
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November 27, 1917

A NEW DENDROMETER

BY DONALD BRUCE

There is a growing demand for a satisfactory dendrometer, or instrument which will measure the diameter of trees at points out of reach from the ground. An indication both of the wide demand and of the requirements which such an instrument must meet may be gained from a consideration of the following instances.

In certain regions, United States Forest Service timber estimators have made use of a volume table based on a diameter measurement at the top of the first sixteen-foot log instead of at the conventional breast-high point. This was on account of the abnormal form of the badly burned butts, which made a lower measurement both uncertain and a poor index of volume. Considerable trouble resulted through inability to check the ocular estimates of diameters except by uncertain methods of measuring at breast height and subtracting the estimated taper. For such cases there is needed a dendrometer of moderate precision, large range, considerable rapidity, lightness, and portability.

Many volume tables are based on a measurement of height to a certain fixed cutting limit, such as six, eight, or ten inches top diameter. From the ground it is often more difficult to identify this point than it is to estimate its height, and considerable errors result. Instruments of only a small range of sizes are needed, and in fact for a given volume table, or a consistent set of tables, an instrument that can be fixed and adjusted for a single diameter would serve the purpose.

Other volume tables are based on height to the limit of merchantableness. This limit, however, varies widely in different regions, even for a single species, and to use such a volume table accurately one must know the top diameter corresponding with each value of the table and estimate heights accordingly. Exactly the same type of instrument is required as in the last case, save that a slightly larger range of diameters is needed and a fixed adjustment for a definite size is not adequate.

Many Pacific coast volume tables are based on diameter, height, and taper. While the first two factors are measured, at least occasionally, the last is usually a matter of guesswork entirely. The instrument needed to strengthen this part of the work is a dendrometer possessing the qualities above mentioned, and in addition one which works independently of distance, since both horizontal distances and heights will usually be but roughly approximated.

In many scientific studies of growth on permanent sample plots in this country periodic measurements of diameters breast-high and



Fig. 1

heights are being secured, and growth in volume is being calculated from these data by means of a single volume table for each species. As a result, whatever growth results from a change in tree form is being neglected. A dendrometer is needed of considerable precision, but not necessarily so portable or rapid in action as in the previous cases. Its range in most cases need not be great, since the more important growth problems are connected with second-growth timber or, at least, with trees below a certain diameter limit.

Schiffel's formula for obtaining volume has not been sufficiently tested for most American species, but it is regarded as probably having a high value in many cases. It requires a measurement of diameter at a point half way up the bole, and hence a dendrometer. The qualifications of a satisfactory instrument will naturally depend on the character of the work being done.

All these instances indicate that it is not due to the absence of a real need that dendrometers are practically unknown in America. It seems obvious, rather, that no existing type satisfies the conditions

above outlined. The following pages describe an instrument based on a somewhat different principle from those previously devised, which will be seen in a large measure to meet these requirements.

It consists essentially of a straight arm upon which are mounted two small mirrors, both at an angle of 45 degrees with the axis of the arm, parallel to each other and facing in opposite directions (see fig. 1). One mirror is fixed at one end of the arm, while the other is mounted on a slide which travels along the arm. Graduations permit a direct reading of the distance between the mirrors.

The principle is indicated by figure 1 which shows the relative position, as seen from above, of tree, observer's eye, and of the instrument when in use. It will readily be seen that the instrument is closely akin to the ordinary calipers in principle, except that for the parallel fixed and movable arms of the calipers are substituted two parallel lines of sight. The direct line of sight passes just above the upper edge of the fixed mirror from eye to one edge of the tree, while the indirect line of sight is reflected in each of the two mirrors to the other edge of the tree. That the two lines of sight are parallel and hence that the distance between the mirrors is equal to the diameter of the tree is too self-evident to demand geometrical demonstration.

In use the observer holds the dendrometer arm horizontal (if the tree is in the normal vertical position) with one of the mirrors in line between his eye and the left-hand edge of the tree at the point to be measured. He then catches the reflection of the second mirror in the first, thus bringing the arm into a line perpendicular to the line from eye to tree. By sliding the second mirror in or out, the right-hand edge of the tree will become visible in it. The adjustment is now continued until the left-hand edge as seen directly and just above the fixed mirror, and the right-hand edge as seen indirectly through the two mirrors, are in a straight line, one immediately above the other. The distance between the mirrors as read from the graduations on the arm is then the required diameter.

The advantages and disadvantages of the instrument are evident.

- a. It is direct reading.
- b. The distance from the observer to the point observed does not have to be determined.
- c. As a result, the instrument is rapid in use.
- d. It may be set for a given diameter, regardless of distance.
- e. It is light in weight and of convenient shape for carrying; it is more portable than a pair of calipers of the same range.

- f. It will measure only a moderate range of sizes.
- g. While very accurate for a hand instrument, it is not capable of extreme precision.

The reason for the last two statements will be explained in the following pages.

It is evident that it will meet quite well the requirements already outlined. It fails at two points only—its moderate range might prevent its use in very large timber, and its lack of absolute accuracy may militate against it for very precise, scientific work.

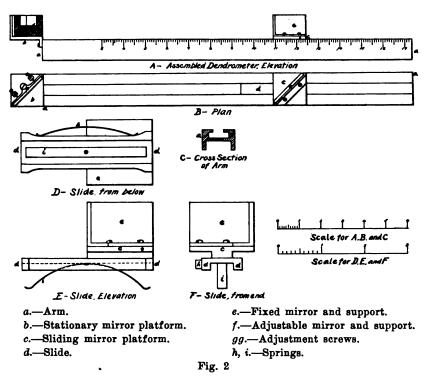
Most of the errors of such a dendrometer are easily kept negligible. Of course at any considerable distance, small variations of diameter are imperceptible and cannot be measured. Since the minimum visual angle for normal eyes is one minute, two-tenths of an inch is the smallest variation recognizable at a distance of fifty feet. This consideration applies equally to all dendrometers which do not involve telescopic observations, and the use of a telescope at once means a heavy and awkward instrument.

If the arm is not held at right angles to the direct line of sight, the graduations on the arm will no longer measure the distance between mirrors along the indirect sight line, nor will this distance agree with the desired diameter. However, this error can never be large since, unless the arm is in approximately the correct position, the second mirror cannot be seen at all in the first, and to center its image therein is an instinctive proceeding. For more precise work, however, an additional aid may be afforded by vertical lines scratched into the backing of each mirror at its exact center, which are to be brought into apparent coincidence when the instrument is in use. An alternative method of obtaining the same result is to mask the fixed mirror with dark paper until, at the most convenient distance from the eye, the whole of the movable mirror can just be seen in it. The position of such a mask is shown in figure 2, A.

A rotation of the dendrometer about the axis of the arm will, of course, raise or lower the indirect sight line running from the instrument to the tree. Here again, however, unless the position is essentially correct, the image of mirror 2 cannot be found in mirror 1. The error resulting, moreover, is merely the amount of taper that occurs between the points observed by the direct and indirect sight lines, which is usually negligible.

Of course, if the two lines of sight are not parallel, serious errors will result. This depends on having the two mirrors parallel and is

in part a matter of adjustment. Two opposed adjusting screws must therefore control the rotation of one of the two mirrors. Adjustment is simple. Some target of known diameter or breadth (a sheet of paper against a dark background will serve) is observed with the instrument set at the corresponding diameter. The mirror is then rotated by its adjustment screws until the two edges appear in line. This process is delicate, but neither complicated nor difficult.



The one error which dominates all others is that due to a failure of the arm to be absolutely straight. This is unfortunately a matter of instrumental construction and not of adjustment, and the difficulty of making this arm straight is surprisingly great. It is obvious that almost imperceptible deviations will result in slightly diverging or converging sight lines and in increasingly serious errors in the diameter readings, as the distance at which the measurement is taken is lengthened. In the instrument described the maximum error from this source is .6 inch when used at fifty feet; it is doubtful if materially better results are obtainable. This is not excessive. Even with a transit read to the nearest minute, the diameters fifty feet away can be read

but to the nearest .2 inch. With a hand instrument of the common type which involves the measurement of the angle between two sight lines it is difficult to provide for an accurate reading closer than to the nearest 10 minutes. This means that at the same distance 1.7 inches would be the minimum recognizable difference in diameter.

Figure 2 shows the details of construction. a-a, of A, B, and C, is the straight arm which is made of a casting of aluminum alloy. The straight edge is the back surface of the slot which is recessed into the upper surface of the arm, as is best seen in the cross-section. This cross-section is perhaps unnecessarily heavy, but was so designed to insure as perfect a straight edge as possible. In this slot travels the slide d shown in detail in D, E and F, which are drawn to twice the scale of A, B and C. This slide is equipped with two springs, h and h, which hold it against the back and upper surfaces of the slot. Upon



Fig. 3

it is mounted the mirror platform, and mirror e turned to an angle of 45 degrees to the axis of the slide. At the end of the arm a second fixed mirror platform, b, is mounted on which is the second mirror, f, which can be adjusted by the two opposed adjusting screws, g-g. This mirror is shown with both center line and mask, though both are hardly necessary. The scale is readily seen in A. This is read by means of the small arrow engraved on the side of c, as shown in both A and E. In A the reading, for example, is 12.2-.

If the weight of the instrument, slightly less than 27 ounces, is found objectionable, it would probably be safe to lighten materially the cross-section of the arm by reducing both the depth of the downward projecting ribs and the thickness of the lateral walls. The mirrors also, as shown, are very generous in size, and might be reduced to about two-thirds the indicated dimensions without introducing any serious difficulties through restricting the field of vision.

¹ To Mr. V. Arntzen of the Civil Engineering Laboratory of the University of California, credit is due for the major part of the detail of design.

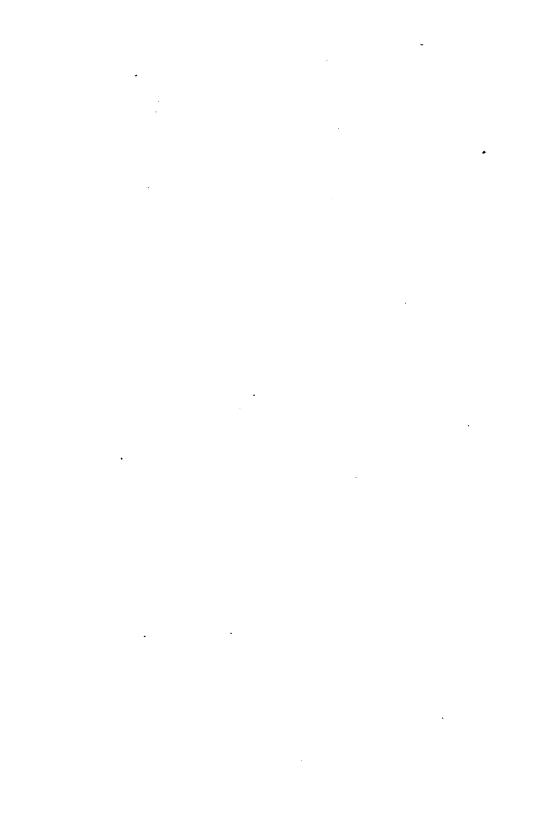
The instrument shown has an arm eighteen inches long and will read diameters from three to seventeen inches. A longer arm is, of course, possible, but at about thirty inches a point is reached at which the adjustment of the sliding mirror when held in working position would become awkward. This may then be taken as the practical limit, unless some modification of the principle be adopted. range will be sufficient for a great deal of the work to be done. Τf less accuracy is required, measurements of double this size can be secured by taking the center of the tree as the target for the direct line of sight, instead of the left-hand edge, and bringing the reflection of the right-hand edge in line with the center point. This operation can be performed more accurately than might at first be supposed, and the method, while rough, is probably quite adequate for work in connection with the Pacific coast volume tables already mentioned, in which taper is a factor.

A quick field test of the parallelism of the sight lines consists in measuring the same diameter at two different distances. The readings should, of course, be identical, or rather, since a small observational error is unavoidable, as nearly identical as would be two consecutive measurements from a single position. If an error is found and it is not convenient to make the proper adjustment it may be simply and quite accurately allowed for, by taking consecutive observations at two known distances. For example, suppose the first reading is 14.8 inches and the second reading taken at one-half the distance is found to be 14.4 inches. Since the error is proportional to the distance, a reduction of the distance to one-half must also reduce the error to one-half. The reduction in error is .4 of an inch, the total original error must have been .8 of an inch, and the correct reading is therefore 14.8 - .8 = 14.0 inches. Where the errors are small, the major portion of them can thus be eliminated, even if the distances are estimated instead of measured.

A modification of this type of dendrometer is suggested for timber survey crews which are using volume tables to a fixed top-cutting limit such as six or eight inches. All that is necessary in such cases is the pair of parallel mirrors, one of which is adjustable, mounted six or eight inches apart on any light but rigid base not affected too readily by changes of temperature or humidity. By thus eliminating the straight edge and slide of the instrument herein described, the most serious source of error will be eliminated and the cost largely reduced.

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